THE JOURNAL OF SPEECH AND HEARING DISORDERS

Volume 17 June 1952 Number 2

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The American Speech and Hearing Association
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November 20-22, 1952, Detroit, Michigan

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THE PROGRAM for the 1952 Convention is now in its final stages of preparation. The Program Committee will continue to receive, until September 1, abstracts of papers and addresses for presentation at the Convention.

If possible, papers should fall into the following general categories:

1. Public School Problems
2. Speech Pathology
3. Audiology
4. Speech Science

It is suggested that papers be composed for approximately 15-minute presentation. Except under extraordinary circumstances no paper can be accepted which requires more than 20 minutes for presentation.

All abstracts must be received by September 1, 1952. In addition to summarizing the paper each abstract must indicate (a) the full title of the paper and the name of the contributor as requested for listing in the printed program, (b) the time requirements, (c) details on the type of visual or audio aids needed, and (d) special requirements. The professional affiliation of the author should be stated.

Receipt of an abstract will be taken as evidence that the contributor is aware of the following rules governing the conduct of section meetings:

1. All meetings will begin when scheduled.

2. Chairmen will, without exception, hold the speaker to the time limits set forth in the printed program.

3. Speakers should prepare papers in such a way that briefer summaries may be given in case an emergency necessitates shortening of presentation time.

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The Use Of A Group Structure In Speech Therapy

Ollie Backus

IN ALL OF the social sciences it is being recognized increasingly that greater precision in the conceptual analysis of a given problem has as much importance in research as greater precision in the collection and analysis of the observed data.

In the field of psychotherapy Rogers (*1*) has said, 'We have proven in our own experience Kurt Lewin's oft-quoted statement that "nothing is so practical as a good theory." ' He goes on to quote the following statement made by Elton Mayo:

> Speaking historically, I think it can be asserted that a science has generally come into being as a product of a well-developed technical skill in a given area of activity. Someone, some skilled worker, has in a reflective moment attempted to make explicit the assumptions that are implicit in the skill itself. The assumptions once made explicit can be logically developed; the development leads to experimental changes of practice and so to the beginning of a science.

Some relatively well-developed technical skills now exist in the area of group speech therapy. Many of the assumptions implicit in those skills have been made explicit; various changes of practice have been explored. It now appears that an attempt at theory construction should be made—meagre as that must be at this date—for the sake of both research and clinical practice.

Whatever statements are made about group speech therapy are determined not only by the nature of the process itself, but also by the individual's own conceptions of that process and how he has experimented with it. The writer's experience during the last 10 years has involved clinical experimentation with group therapy. Associated with this has been an intensive study of the literature of the various fields engaged in the development of the science of man; and, more recently, some experimentation in applying clinical knowledge and skills to the teaching of speech to persons not having speech disorders.

Speech therapy has been viewed as involving not only the mechanics of speech production, but also use of speech in interpersonal relationships. Clinical programs have occupied several hours a day for several weeks at a time and have had a group membership composed of persons presenting various kinds of speech symptoms. This experimentation by the writer and colleagues has involved individuals of all age levels and all types of speech disorders.

The meeting together of clients in groups resulted in the observation of phenomena that had not been so evident before. This broadened the conception of speech therapy, which in turn produced modifications in the

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conception of a group structure as an instrument of therapy. There came, too, a growing sense of the relatedness of speech therapy with other fields dealing with the process of change in behavior. Thus it has been felt that the development of theory about group structure in speech therapy needs to be consistent with speech therapy generally, and this in turn with therapy generally.

Analysis of Group Structure

Certain assumptions can be made about therapy generally:

1. Whatever the laws that govern the process by which changes in behavior come about, they are conceived as operating broadly: in speech therapy, psychotherapy, in education, and indeed in life generally, wherever human growth is conceived to be going on. Thus in verbal constructs, we should avoid creating a dichotomy between what is called 'therapy' and what is called 'learning.' At the same time, we need to locate on the continuum the processes called therapy, as having some distinguishing characteristics. It seems probable that 'content' constitutes the most critical variable. Thus at one end of the continuum, the content of psychotherapy is almost entirely concerned with how the client feels about reality as he perceives it. At the other end of the continuum, the content of classroom education is concerned also (and especially) with information and skills. Between the two points on the continuum, yet near psychotherapy, the content of speech therapy is concerned somewhat with information and skills related to speech, but also with how the client feels about his perceived reality.

2. Each individual has to do his own changing, his own learning, rather than having it somehow done to or for him. Thus the structure of such changing is not accurately represented by use of the passive voice, 'he was taught.'

3. Behavior includes not only directly observable phenomena, but also inferred processes at deeper-lying levels, psychological as well as physical. Such deeper-lying processes are conceived to have profound influence upon the observable aspects of behavior.

4. Basic changes in behavior involve what is often called 'emotional' as well as 'intellectual' working through of a problem. They may lie outside, as well as inside of a client's awareness.

5. Repetition of an activity is not considered the only variable in effecting changes in behavior; in many cases it is probably not even a very essential variable. Changes in the meaning a situation has for the client, as well as changes in his needs, values, and goals, are considered as important variables.

6. The structure of therapy is conceived of in terms of relationship, and hence it must be defined both in terms of therapist and client: *what the therapist does* in relation to *changes that occur in the client.*

The term 'therapy' may then be defined in this way: a particular kind of interpersonal relationship in which at least one of the participants (therapist) seeks consciously to keep creating the sort of environment in which each other participant (client) can develop his own potentialities to the greatest extent possible at successive points in time.

The advent of the term 'group' applied to therapy implies that something called 'individual' therapy exists, and that there are differences in structure between the two. Individual

therapy may be defined as a two-person relationship, a configuration made up of the interactions of one therapist with one client. Then the lower theoretical limit of group therapy can be defined as a configuration made up of the interactions of one therapist with two clients. It should be noted, however, that in the literature on group therapy the term 'group' usually refers in practice to a number ranging from six to 15 individuals, although an optimum membership has not yet been determined experimentally.

Both the two-person and group structure have this in common: at surface levels they consist of an aggregate or sum of the individuals present; at deeper-lying or psychological levels the interactions among individuals form a design or unit which is *not* equivalent to the sum of the individual members. The essential difference in design appears to be this: in a two-person structure the configuration involves the possibility of interaction only between client and authority figure;[1] in a group structure the configuration involves the possibility of interactions with peers, as well as with an authority figure. (The term 'possibility' includes not only those interactions in which a client himself may participate, but also those in which he may perceive other clients participating.) This difference may be viewed as creating a range of possibilities and limitations for each type of structure as an instrument of therapy. The potential of each type may be assumed to become actualized only through the application of procedures which are appropriate to each.

In considering the relative merits of group structure and two-person structure in speech therapy, certainly the issue is *not* one of assembly-line efficiency as against 'individual attention.' Since individual growth represents the goal in any sort of therapy, such relative merits must be determined by the extent to which the use of each can facilitate growth in a given individual. Furthermore, the issue is not whether individual *or* group therapy should be used. The writer has specified previously that by definition group therapy includes a combination of individual-group work. In a given program of therapy a group structure involving the entire membership forms the core of the program; associated with this is the use of a group structure involving subgroups, and the use of a two-person structure both for instruction and counseling. But the two-person interactions which occur as a function of the group relationship are very different from those which occur alone without the group relationship. The client-authority-figure patterns are different, the material discussed includes mutually-shared experiences, the interactions represent both an outgrowth of the group experience and a preparation for future group experience. Thus it appears to this writer that both 'individual' and group therapy should be carried on together within a given program of treatment. The question then becomes one of the proportion of each to the other at various points in the program.

Utilization of Group Structure in Speech Therapy

It has been stated that therapy should be defined both in terms of

[1] In 'individual' therapy, i.e., a two-person relationship in the clinic situation, a frequent practice consists of assignments which require the clinician and client to engage in various types of interpersonal situations outside the clinic. By definition, such situations would be characterized by the term 'group structure' when they involve more than two persons.

therapist and client. As experimentation has progressed, the writer's conceptions have changed concerning *what the therapist does* in relation to *changes that occur in clients*. In the beginning, 'changes in clients' meant chiefly surface manifestations in respect to speech; hence, 'what the therapist does' meant chiefly class procedures designed to give clients practice in developing such skills. Gradually 'changes in clients' came to mean especially the deeper-lying changes in attitudes, perceptions, needs, values, goals, which would make it possible for them to change speech behavior; hence, 'what the therapist does' came to mean not only procedures for group activity, but also *how those procedures could be utilized* to produce the deeper-lying changes in clients.

A significant instance is an adolescent with history of birth injury who over a period of years had not developed much speech, but otherwise showed intelligence within normal range. He began speech therapy—a process which cannot remove any lesions in nerve tissue—and gradually developed more speech. If the brain lesion prevented him from developing speech before, and if that lesion still remained, what went on in him that enabled him to do what he apparently had not been able to do before? Simply to say, 'He was taught how,' or even, 'He learned,' does not explain the structure of the process.

It has been assumed that each client must do his own changing, and that the therapist's function is defined as one of creating the sort of environment in which the client becomes able to change. The questions must be asked: 'What characteristics does this environment have, in which a client becomes able to do what he apparently could not do before?' 'How can a group structure contribute to this end?' It appears that three characteristics can be specified:

1. *An atmosphere or psychological climate in which a client can feel belongingness, acceptance, security.* All human beings are regarded as having in greater-lesser degree feelings of anxiety, hostility, frustration, guilt; perceptions of self as weak, inferior to, or dependent upon others; perceptions of other people and situations as threatening; defenses against these feelings. Such conditions, to the extent that they are present, are considered barriers to growth in anyone, including clients in a speech clinic. Individuals are not able to modify these conditions simply by being told that they 'should' or 'can,' but rather through experiencing a relationship in which they can come to feel accepted, secure, safe. Such an experience may *happen to occur* in everyday life or it may be consciously structured in therapy.

A two-person structure can provide such an atmosphere, but a group structure appears to offer even more possibilities.

a. The experience of being in a group with others who have various kinds of defective speech can make a profound impression toward changing feelings of isolation and inferiority.

b. The clinic group can provide a membership perceived by the client as very different from groups at home; as one in which he can come to view himself as capable of attempting to engage in participant belongingness.

c. A group decision to engage in feared activities can enable individuals to do collectively what they have not been able to do alone. Since it is the actual experience, rather than merely

'being told' that counts in changing the meaning that a situation has for an individual, and since avoidance of feared activities robs him of the chance to gain different meanings, this function of the group serves important ends.

d. Because a group structure makes possible the structuring of a variety of interpersonal situations right within the clinic program, therapist and clients together can experience and then discuss the situations out of which come examples of behavior to be changed. This is particularly desirable in an educational program (outside the specialized field of psycho-therapy), where a consideration of *present* problems is viewed as less hazardous than delving into the past.

e. As group members become increasingly able to express in words their problems, experiences, attitudes, feelings, they gradually validate by experience the actual universality of problems which before they had considered personally private and unique to themselves.

f. Membership in groups in everyday life is as apt to have traumatic as well as therapeutic value; but membership in a clinic group—where a therapist is helping the whole membership to create an atmosphere of acceptance of each person—can provide conditions for growth rather than trauma. Such growth in a clinic environment can reduce the frequency of traumatic experience outside, both because of changes in the client's interpersonal behavior and because of changes in the way he views events that do occur. 'Conditions for growth' does not mean that 'failures' will not occur within the clinic program—indeed they are expected; it does mean that the client can be helped to understand his failures and move through them.

g. The perception of authority relationships can change in important ways within a group structure. The client has his two-person relationships with the therapist, he knows that other clients have similar relationships with therapist; he also witnesses the various peer - with - authority configurations within the group activities. This can help to prevent some of the dependency relations which many clients actually promote and yet to which they have strong feelings of resentment. It can also provide experience with 'rational authority' as over against the 'irrational authority' which has characterized many of the clients' past experiences.

Creating an atmosphere in which significant changes can occur includes but requires much more than the condition often called by the layman 'high morale' or 'group spirit.' This often contributes to changes in a client temporarily, and sometimes in some clients appears to have produced some lasting effects. It should be stressed, however, that that term is by no means equivalent to the term 'atmosphere' as used here in relation to therapy. If a client has been able to engage successfully in some clinic activities but leaves the session basically unchanged, for example, with his hostilities unexpressed or with basic conflicts unresolved, then the probability is high that his gains will not have permanence.

The creation of an atmosphere appropriate at any given point in time for dealing with the problems at hand represents a complicated process and demands of the therapist: (1) a sound knowledge of the dynamics of behavior, (2) the use of procedures specifically suited to a group structure, (3) skills in utilizing those procedures for therapeutic ends.

2. *Activities which facilitate observation in the client.* We deal in speech therapy with the biological process termed 'adaptation,' e.g., an individual soon ceases to have awareness of shoes on the feet or a ring on a finger. A client with defective speech has usually ceased to have awareness of the specific characteristics of his speech, even though he may know from being told or mocked that his speech is different. In speech therapy most clients need to become able to observe these differences sharply. Activities which facilitate observation include those traditionally used for the production of speech sounds. These include not only listening, but also the motor aspect of producing sounds, since sensory-motor functions are not dichotomized at process levels into separate acts of sensation and execution.

Since changing behavior in respect to speech production probably depends more on perceiving differences sharply than on repetition of attempts, a group engaged cooperatively in such a task offers some advantages over the two-person structure. A client can observe not only his own and the therapist's production of sounds and patterns, but also that of other clients. He has his attempts evaluated not only by the therapist, but also by other clients, and he in turn contributes that to others. In a group whose members have a variety of speech symptoms, furthermore, clients demonstrate for others some details of speech which they produce quite accurately and easily, thus getting non-verbal experience of 'what is right' as well as 'what is wrong' about their speech. It must be emphasized, however, that these advantages do not come when the therapist treats the group only as an aggregation in a room and teaches first one, then another, then a third. Procedures must be formulated specifically for a group structure.

Activities which facilitate observation also include experiencing and analyzing various interpersonal situations, so that each client can become able to observe his own behavior more realistically, e.g., to note differences in his perception between situations where he interacts with peers in contrast to those involving authority figures; to note the adjustive techniques employed; also to observe effects of his behavior upon others. The *physical* structure of the group provides the number of persons required for carrying out such a variety of situations within the clinic program. The *psychological* structure of the group provides a source of support for clients to become able to make observations which they either had ignored or had not been able to tolerate consciously before.

3. *The availability of tools with which a client can move ahead.* In speech therapy the acquisition of motor skills, such as producing consonant sounds, may be conceived of as tools with which the individual can move to more normal use of speech.

Social skills, i.e., how to make introductions, order in a restaurant, engage in small talk, are also conceived of as tools. Clients have reported again and again that the sureness of what to do in various social situations had reduced pressures, had enabled them not only to engage in such situations outside of the clinic, but also to derive real satisfaction from such participation.

Finally, the scientific principles as presented in the discipline called general semantics are conceived of as conceptual tools which clients can use in guiding and evaluating behavior both within the clinic and in continued

growth outside. Experience in using these as tools indicates that they should be presented with a minimum of verbalization, but then applied consistently within the clinic program at non-verbal levels in day to day behavior and in verbal analysis of behavior. While it is possible to make these tools available to clients in a two-person relationship only, the experiences within a group appear to provide greater possibility of helping them to get a deeper 'emotional' understanding, rather than merely an 'intellectualized' acquaintance.

Summary

An attempt has been made to state explicitly some assumptions underlying the use of a group structure in speech therapy. Therapy as a specialized growth process has been located on a continuum in relation to general education; some distinction in location has been made between speech therapy and psychotherapy. Some assumptions about the process of therapy have been stated; a definition has then been formulated. Similarities and differences have been made explicit between a two-person and group structure. The relative merits of each type of structure need to be judged by the extent to which the use of each type can facilitate growth in a given individual. The assumption is made that a two-person structure will be used in conjunction with a group structure. It is pointed out that two-person relationships occurring as a function of a group relationship are different from those occurring alone.

The structure of therapy needs to be defined both in terms of therapist and client. The critical changes in behavior of clients are viewed as those occurring at dynamic levels, which make possible changes in observable behavior. What the therapist does is conceived of not so much in terms of specific behavioral procedures, as in terms of creating the kind of environment in which clients become able to change. Three characteristics of such an environment have been specified: a psychological climate in which the client can experience belongingness, acceptance, security; activities which facilitate observation in the client; availability of tools with which the client can move ahead. Potential contributions of a group structure have been suggested in relation to each.

This attempt at conceptual analysis is admittedly crude at this date. It constitutes a beginning, however, to be corrected and refined through further clinical and experimental work.

Reference

1. Rogers, C. *Client-Centered Therapy* Boston: Houghton Mifflin, 1951.

A Complete Cleft Palate Program

Wayne B. Slaughter
Gretchen Mueller Phair

THIS PRESENTATION is a summary of the evolution and the present-day mechanics of a program designed to render services necessary for rehabilitation of cleft lip and cleft palate patients, and to show that this service can be integrated with existing services for crippled children irrespective of the patient's financial status or geographic location. In this program, the interests for betterment of service to the patient have resulted in a research program that is now felt to be the basis for increased service rendered to the individual, an incentive for better teaching to the undergraduate and graduate student of the various specialties pertaining to the program, and more adequate understanding of the statistical data that have been accumulated.

History

In the State of Wisconsin the development of a statewide program for the care of the cleft palate child has been going through an evolutionary process for a number of years (*2*). The development has been complex because of the numerous agencies and personalities necessary to give complete care to persons born with cleft lip and cleft palate defects (*5*). It was necessary, furthermore, to integrate this program with the over-all crippled children's program (*8*), and to change the concept of treatment necessary to attain acceptable levels of rehabilitation.

Many parents are unprepared to meet the situation when a child who possesses a cleft lip or cleft palate enters the family circle. Realizing this as a combined educational, social and financial problem, the Wisconsin laws enacted have been so amended that all phases of the education and rehabilitation of crippled children begin at the family level (*7, 9*).

Funds are provided when necessary for transportation of the patient to indicated centers and for special teachers and social service workers to help carry information and aid directly to the family following the request of the local physician. This service is available to all parents having children with any type of defect that can be wholly or partially remedied through special education, prosthetics, surgery, or a combination of these services. This service is not limited to those possessing clefts of the lip and palate but includes those in a general crippled children's program.

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By 1943 all necessary legislation had been enacted so that a clinic might be started that would embrace patients of all financial brackets in the state, a geographic unit large enough so that statistics of a total population would be significant. The burden placed upon the Bureau for Handicapped Children was increased since its task was to integrate services at all levels (*6, 11*).

To the existing facilities were added an intensive speech training course and facilities for orthodontia and prosthetics. About a year was required to bring these departments into full action, and then it was realized that to carry out the research necessary for longitudinal growth studies of congenital defects of the face, additional facilities would be needed. In 1945, cephalometric roentgenographic studies were incorporated in the new records along with plaster models, photographs, and routine head plates.

Thus the enactment of beneficial legislation and the gradual evolution of services for all handicapped children paved the way for the integration for the many services which are essential in the complete rehabilitation of the cleft lip or cleft palate child (*10*).

Necessity of Program

Does the number of cases justify such an elaborate program? How often does this problem of harelip or cleft palate occur? What are the services necessary for complete rehabilitation? To answer these questions it can be said that in Wisconsin about one in every 770 births is one with a cleft lip or cleft palate (*3*). This has been a relatively constant factor for the last 17 years and is in proportion to the birth rate. In terms of a state program, this means that in Wisconsin there are born every year about 100 children with this type of congenital defect. Other congenital defects are also incorporated into the general program. These include transverse facial clefts, ear deformities, bifid noses and allied cleft deformities. Considering these figures, the Bureau for Handicapped Children of Wisconsin may have on its rolls, from birth to 21 years of age, between 1800 and 2000 children with clefts of lip or palate, or associated defects.

Since the program is set up to service a 'total population,' the cases include those paid for mutually by the state and county, those paid for in part by the patient and those who personally pay the full financial obligations incurred. This prevents the statistics being colored by one geographic or financial group.

Personnel

A large staff is essential to implement all the desired services. To function in a large community or on a state-wide basis means that some of the activities can be carried out best in the proximity of the patient's residence. The University of Wisconsin School of Medicine and the Wisconsin Orthopedic Hospital act as the focal point for the entire state. The administration of the program centers around the following specialists: three speech therapists utilized on a state-wide basis, who aid some 50 other speech therapists whose main activities do not include instruction for those with cleft lip or palate defects; five orthodontists, two at the clinic in Madison and the remaining three out in the state; two plastic surgeons operating at the Wisconsin Orthopedic Hospital in Madison; an oral surgeon; a pediatrician; two prosthodontists; an otolaryngologist; the resident house

staff; a full time social worker at the clinic, who coordinates efforts with the local health set-up and local physician or directly with the private patient and his physician.

Practical Function of the Program

By Wisconsin law, all children born with a congenital deformity must be so reported by the attending physician on the birth certificate. These certificates are filed with the State Board of Health. Reports of congenital deformities are sent immediately to the Bureau for Handicapped Children, and the attending physician or local public health nurse is contacted to see what plans are in store for these babies. If indicated, plans for immediate examination are made.

All children, regardless of their financial status, must be referred by the family physician. This factor has been of tremendous help in statistical studies and follow-up of these children and other members of the family because of the local doctors' interest in the welfare of their own cases. Following the referral of a child, a staff member of the Bureau for Handicapped Children contacts the family. The specific problems of the child are discussed, and the parents are informed of the possibilities of service for the particular problem encountered. Future plans are discussed so that a complete program of rehabilitation is considered.

In most instances, a diagnostic phase follows the initial contact with child and family. Referral can be made to the Wisconsin Orthopedic Hospital, University of Wisconsin Medical School, in Madison. Provision is made for the indicated medical examination and mental evaluation, and suggestions are given for immediate or deferred surgery, orthodontia, prosthodontia, and speech training. Results of the findings of the diagnostic group are interpreted for and discussed with the family by the social service nurse who has been specially trained for this duty.

Upon the arrival at the hospital, the patient or parents are interviewed by the social service nurse. A summary of previous service is compiled for the plastic surgery service, the pediatrician, orthodontist and speech therapist who see the child, as a group, at the initial examination. The child is examined in the presence of the parents, the examiners dictating their findings and recommendations at the time. Photographs, models, and X-ray studies, plus a complete physical examination and a history from either the patient or parents are obtained if the child is to be admitted. If the child is not admitted to the hospital at this time, the portion of the above records that is needed for the statistical records is filed.

Copies of this examination report are sent to the referring physician, to the local public health nurse, and one copy is kept for records at the hospital. Plans for following the recommendations are worked out in detail with the child and parents if they are so willing. If necessary, any county judge may, with the approval of the Bureau for Handicapped Children and upon recommendation by the patient's family physician, cause any resident child to be admitted to the Wisconsin Orthopedic Hospital and arrange to have the costs 'paid one-half by the state and one-half by the county of his legal settlement' (*1*). In case there is need for additional financial aid, the cooperation of local agencies is often sought, or, in some cases, private or public charities are approached.

Timing of Procedures

In general, it may be said that surgery for cleft lip defects is done as soon as the baby has regained his birth weight and is in otherwise sound physical condition. The closed lip acts to guide the rapidly developing facial framework. In the soft tissue closure of the lip no 'moulding' or contouring of the bone is carried out. Further surgery may be required to improve the appearance, aid speech, direct growth of teeth and gums, and to facilitate deglutition. Surgery, or surgery plus orthodontia or a prosthetic appliance, are the various avenues open for carrying out the basic steps in rehabilitation.

Cleft palate surgery may be as early as 20-24 months of age, but this is extremely variable, and, in definite classes of defects, palates are not closed by surgery alone. Just where the ultimate definitive treatment will lead depends upon the findings of results in control groups wherein their growth patterns are recorded and measured. These measurements dictate the method of procedure, as has been pointed out in a previous article (*4*).

The rapidly developing bones of the face can be directed or guided into proper channels of so-called normal patterns in those persons having clefts. Bone growth centers can be partially or totally inhibited without actual physical contact with that specific center. Therefore, a growing dependency upon physiological help in the form of muscle activity and orthodontia to aid in directing this growth potential into proper channels is becoming more and more evident. Trying to force existing patterns to change their course through injudicious surgery or over-zealous orthodontic interference can lead only to failure in the eyes of the patient and of society. Orthodontia properly carried out can be of extreme benefit on either the permanent or deciduous dentition. Pre-operative or pre-prosthetic orthodontia procedures may terminate in a more normal contour of the dental arch with plastic surgery following orthodontia. In other instances orthodontia may follow plastic surgery to re-align the teeth, and give functional occlusion with or without the use of restorations or obturators.

Speech

Formal speech training for cleft palate children in the Wisconsin program is usually started at four to five years of age. This is initiated as a concentrated course covering eight weeks and is under the joint sponsorship of the University of Wisconsin Speech Clinic, which provides the teachers; the University of Wisconsin Orthopedic Hospital, which provides the classrooms and lunches; and the Bureau for Handicapped Children, which provides the supervision, the boarding homes, the walkers who bring the children to and from the school, the transportation, the instructional materials and incidental expenses. The children are present at school from nine to three every day but Saturday and Sunday and have speech training in every conceivable manner. On Saturday, a recreational program is planned, with movies, visits to the zoo, picnics, and beach parties.

Boarding homes are chosen only after the parents approve them. Families are expected to pay all or as much of the incurred boarding home expense as possible, or local public-spirited agencies are extremely helpful in defraying these costs. The unpaid balance is paid for by the Bureau for Handicapped Children.

While the child is in speech school, he is re-examined by the plastic surgeon, otolaryngologist, orthodontist, pediatrician, and speech therapist, and additional records are made. Hearing tests, psychometric studies, and a complete examination by the department of otorhinolaryngology are made during the speech school session. If changes in the general program for the child are to be considered, they are again discussed with the parents at this time. In general, medical and surgical check-up examinations are required every six months for the first three years after surgery and once per year after that.

Speech correctionists who are attending summer school may work in the speech training center and get special help in the cases presented. These speech correctionists in the state work in cooperation with the Supervisor of Speech Correction, who is on the staff of the Bureau for Handicapped Children. All speech therapists are licensed teachers in the state, travel from school to school in their local school system and meet with their pupils once or twice a week. They are hired by the local school boards and their salaries are reimbursable in part by the state as special teachers. They may at any time ask for help from the Bureau for Handicapped Children for a particular child, or the child with cleft palate speech may be sent to the speech training center for any additional necessary care. The coordinator of speech therapists from the Bureau for Handicapped Children spends one day a week in the plastic surgery clinic so that the diagnostic group gets an opportunity to discuss individual cases and possible corrective measures in any specific case. Close cooperation between the local speech teacher, the medical school facilities, and the Bureau for Handicapped Children is thus assured (*3*).

Summary of Progress

Since 1943, the program for complete care of cleft lip and cleft palate children has been carried out as a service, teaching, and research program. Studies have forced changes of preconceived ideas on growth in persons possessing congenital deformities and will probably continue to do so in the future. This service is based on a case load dictated by the number of total births of live babies within the state. The back-log of untreated cases and those needing additional surgical, orthodontic or prosthetic care have largely been removed from the rolls of the Bureau for Handicapped Children.

Certain results have been noted. The present five- and six-year-old group needs less orthodontia than those in older age groups. This seems to indicate that there may be improvement in the technical handling of cases. The amount of prosthetic restorations necessary has also decreased in this group. The total number of operations per patient has steadily decreased in spite of the utilization of a two-stage procedure for closure of the bilateral cleft of the lip, thus cutting down the over-all financial burden to the individual and to the state.

The presentation of a definite plan at the primary examination of the case has resulted in the highest degree of cooperation from the parents and patients. The cooperation and assistance of the various specialties other than surgery in the care of those possessing cleft deformities has apparently been of increasing benefit to the patient.

The entire rehabilitation program of the cleft lip or cleft palate child is a long-time proposition. It begins with

the moment of his birth and continues until he has been made a satisfactory member of society. There must be some continuity in the program planned for him. Since the services mentioned may take 15 or 16 years of a child's life, there must be a continuous thread of planning and action woven into the whole pattern to unify it.

After all services have participated and their portion concluded in the program for the rehabilitation of the cleft lip or cleft palate child, a final evaluation is carried out. Rehabilitation is considered complete if a satisfactory cosmetic result has been attained and if the speech and occlusion of teeth are as normal as possible.

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Speech Disorders And Speech Correction

ASHA Committee on the Midcentury White House Conference

(Editor's note: This is one of a number of papers which served as resource material for the Fact Finding Report of the Midcentury White House Conference on Children and Youth, published in the Fall of 1951. It was written by the Chairman and reviewed by the members of the ASHA Committee which served during 1950 and 1951. Upon its own recommendation the Committee was discontinued by action of the ASHA Executive Council at its annual meeting in December, 1951, the further responsibilities within its area of operations being at that time assigned to Executive Vice-President Ernest H. Henrikson.

Publication of this report has awaited clarification of policy with respect to dissemination of materials prepared for the Conference. The procedures of the Conference did not provide for official approval of these papers. Address inquiries to: National Midcentury Committee for Children and Youth, FSA Building North, Fourth and Independence Ave., S. W., Washington 25, D. C.)

CHILDREN with speech disorders make up one of our largest groups of seriously handicapped youngsters. Estimates of incidence are presented in Table I. It is to be stressed that the figures are presented as the lowest defensible estimates; they would be regarded as serious under-estimates in certain respects by some authorities. They leave out of account an estimated additional 5 per cent, or 2,000,000, children who have relatively minor speech and voice defects, unimportant for most practical purposes but serious in their effects on personal and social adjustment in some cases, and obviously significant for children destined for fields of work, such as teaching, requiring good speech.

The fact that such figures are often regarded by lay readers, and even by school administrators and physicians, as lacking full plausibility serves to point up one of the most important aspects of the problem faced by children with speech defects: their difficulties are generally unrecognized and are seldom well understood. A child with a serious speech defect is not likely to talk any more than he has to, except possibly to close friends, and when he is not talking his speech defect 'doesn't show.' He appears to be an entirely normal child. The cumulative effect of this curiously unappreciated circumstance is that the speech handicapped child tends over the years to feel more and more misunderstood, rejected, and increasingly lonely. The psychology of the speech defective is essentially, therefore, the psychology of frustration and discouragement with consequent withdrawal tendencies and feelings of insecurity so far as social relationships and personality development are concerned.

Virgil A. Anderson, George A. Kopp, Darrel J. Mase, Hildred Schuell, Jayne Shover, William G. Wolfe, and Wendell Johnson, Chairman.

TABLE 1. Estimates of incidence of speech defects among children in the United States between the ages of 5 and 21 years, based on an assumed total population of 40,000,000. Gross estimates for all age levels, based on an assumed total population of 150,000,000, and on the same percentages, are also shown.

Type of defect	*Ages 5-21 years*		*All ages*
	%	*No.*	*No.*
Functional articulatory	3.0	1,200,000	4,500,000
Stuttering	.7	280,000	1,050,000
Voice	.2	80,000	300,000
Cleft palate speech	.1	40,000	150,000
Cerebral palsy speech	.2	80,000	300,000
Retarded speech development	.3	120,000	450,000
Impaired hearing (with speech defect)	.5	200,000	750,000
Total	5.0	2,000,000	7,500,000

Since speech defective children do not go about on crutches and appear to have nothing wrong with them, they have been relatively overlooked by the medical profession, by psychologists, and by educators. An examination of pre-medical education and medical school training and internship experience the country over indicates that the systematic and thorough study of the speech function and its disorders is unusual in medical education. This seems to be largely true even in the special areas of pediatrics, orthopedics, neurology, psychiatry, and otolaryngology, in all of which speech disturbances are necessarily encountered in relative abundance. The consequence of this state of affairs is, of course, that most physicians are not thoroughly prepared by special training to examine, diagnose, or treat children with speech defects. These youngsters and their parents must usually turn elsewhere, therefore, with few exceptions, in search of the help they urgently need.

If they turn to the clinical and consulting psychologists, they find a similar situation. While in a few universities clinical psychologists in training may take an introductory course or two in speech pathology, in general nothing resembling adequate preparation for dealing with speech disorders is included in their professional preparation. The result is that few psychologists are well qualified to deal clinically with speech defects.

Disappointed again, those needing help may turn to the schools—public, parochial, or private—and here they find two sets of facts. In the first place, the educational profession generally, as represented by classroom teachers and the faculties of the training centers where they are prepared for their jobs, has given scarcely more attention to the special problems of the speech handicapped than have the physicians and psychologists. A second glance, however, reveals that although very few parochial and private schools do anything about the problem, in a growing proportion of public schools special teachers of remedial speech are employed.

A new profession has come into existence to serve the speech handicapped. The speech pathologist, or correctionist, or therapist, or remedial speech teacher, as he is variously

called, is not a physician nor a psychologist, nor is he a teacher in the usual classroom sense. He is a little of each, to be sure, but mainly he is something else instead. Occasionally these other professional groups seem to feel that he is farming their land, but actually it is land none of them had ever bothered to till because apparently it had never occurred to them that anything worth harvesting might be grown on it.

The evaluation of speech pathologists, and of their professional training programs, is to be governed accordingly. The organization now called the American Speech and Hearing Association was established in 1925, and was designed to fill the vacuum created by the fact that no established professional group had assumed responsibility for meeting the needs of the speech handicapped. In 1943 the Association adopted a revised constitution which defined grades of professional preparation and experience in terms of levels of membership. In 1950-51 professional certification was further defined in terms of two grades, basic and advanced, and separately for workers specializing in speech and hearing, respectively, and with dual certification for those adequately trained in both areas. Responsible administrators concerned with employing speech correctionists or with developing college and university training programs in this professional field may be guided, accordingly, by the certification requirements of the American Speech and Hearing Association.[1]

[1]Information concerning these requirements may be obtained from the Chairman of the Committee on Clinical Certification, who, for the term 1952-55, is Eugene T. McDonald, Speech and Hearing Clinic, Pennsylvania State College, State College, Pennsylvania.

A special problem is to be recognized in this connection by the several state boards certifying public school teachers: speech correctionists are not teachers, in the ordinary sense, and appropriate adjustments in customary certification regulations are necessary if the interests of all concerned are to be properly served.

The professional preparation and certification of speech correctionists must be viewed with particular reference to the need for effective cooperation between speech correction workers and other professional and lay groups interested in the speech handicapped, such as physicians, public health nurses, social workers, clinical psychologists, school teachers and administrators, vocational rehabilitation counselors, parents, etc. As the classification of speech disorders given at the beginning of this report indicates, the disorders differ as to their causes, basic symptoms, the conditions by which they are affected, and the indicated approaches to therapy. In working with the speech of the cerebral palsied, the speech correctionist must cooperate with medical specialists in orthopedics, pediatrics and neurology, and with physiotherapists, occupational therapists, psychologists, teachers, and, of course, the parents. In working with the speech of the hard of hearing another somewhat different pattern of cooperative relationships, including particularly the otologist or otolaryngologist, is to be observed. With cleft palate cases the oral surgeon, orthodontist and prosthedontist are all closely concerned. At the same time, there are many cases of articulatory defect or of stuttering in which the speech correctionist may best take sole responsibility. Even in such cases, however, the speech correctionist must be prepared to recog-

nize the need, or lack of need, for referral to various specialists.

All of this points to a fundamental consideration so far as professional training programs are concerned. Such programs include:

1. Basic general education at the college level.

2. Foundation courses in speech, phonetics, semantics, psychology and mental hygiene, human physiology, and sociology, plus a general orientation to public education.

3. Speech pathology and speech correction: didactic and laboratory courses plus clinical practice under supervision with each type of disorder; research seminars; original research at the Ph.D. level.

4. Essential supplementary training, at advanced levels of preparation, in audiology, anatomy and physiology, psychological testing and counseling, special education, and investigative methodology, including the design of experiments and methods of statistical analysis.

It will be clear to college and university administrators that adequate programs in speech, psychology, and education are essential to the development of satisfactory *basic* training (roughly M.A. degree level) in speech pathology and speech correction, and that, in addition, close relationship with a medical school and hospital is most advantageous in any program of *advanced* training (Ph.D. degree level) in the field.

It is to be noted also, particularly by the governing boards and administrators of public and private agencies concerned with the handicapped, that:

1. Speech correction is essential to the rehabilitation of any type of handicapped person whose speech is defective, and administrative policies governing the working relationships within which speech correctionists carry on their duties are to be kept correspondingly flexible. Speech correction is not properly to be assigned exclusively to medical or to non-medical, to educational or to non-educational, programs.

2. By the same token, the administration and the financial support of speech correction may not properly be arbitrarily restrictive or divisive. For example, certain agencies make funds and services available to a speech handicapped child provided his speech defect has a physical basis, but not otherwise. Any speech clinic supported by an agency with this sort of policy is placed in the position of (a) having arbitrarily to refuse assistance to a substantial proportion of the children applying to it for help, or (b) having to operate with two budgets, two staffs, two sets of equipment, and two separate quarters if money restricted to children with 'organic' defects is not to be spent for children with 'non-organic' defects.

Some types of speech disorder, moreover, and many individual cases, are ambiguous and controversial in these terms. For example, some speech pathologists regard stuttering as a symptom of physical impairment or instability; others look upon it as a symptom of personality maladjustment, or emotional instability; others are of the opinion that it is symptomatic of both physical and psychological impairment; and still others regard it as symptomatic of neither, but simply as a form of learned behavior found in normal individuals whose physical or psychological faults, if any, are not causally related to the stuttering, although they may be

among the consequences of its frustrating and demoralizing effects. The situation is much the same with regard to the problem of delayed speech development, in many cases of which the highly controversial question arises as to whether there exists or is a history of brain damage or primary organic deficit with associated aphasia.

Research in speech pathology, the training of speech correctionists, the management of professional organizations in the field, and the administration of speech correction services are all carried on under conditions such that it is difficult, and it makes for injustices and the uneconomical and inefficient use of facilities and personnel, to operate with a policy that enforces an arbitrary division of speech defectives so that some of them are excluded from programs designed and intended to benefit them.

The demand for speech correctionists has been felt increasingly during the last 25 years or so. One of the major reasons for this has been that through legislative enactments the public school system of one state after another has been opened up to the development of speech correction programs. The result is that in 1950 the number of speech correctionists wanted for jobs actually existing greatly exceeded the number trained well enough to satisfy even the basic certification requirements of the American Speech and Hearing Association.

In 1950 there were approximately 600 members of the American Speech and Hearing Association who met at least the basic certification requirements, plus another 1,000 members who would meet them in the normal course of events within two years. There are probably also a minimum of 500 speech correctionists able to meet the basic certification requirements who are not members of the Association. It is a reasonable conclusion, therefore, that there are now roughly 2,000 speech correction workers in this country with professional qualifications that the American Speech and Hearing Association would consider 'basic' or 'advanced.' A complete program for the United States would require about 15,000 speech correctionists; this would be one to every 10,000 persons of all ages. Assuming 5 per cent of the population to be affected, there would be 500 cases per worker. It is to be considered, however, that this presupposes maximal use of the trained personnel in case work. Actually, from 5 to 10 per cent of the personnel would always be occupied chiefly in administration, professional training and research. Mortality due to death, reaching of retirement age, marriage, and other reasons for retirement probably runs to 10 per cent at the very least, and just possibly to 20 per cent, of the active working force annually. Replacement, therefore, requires from 100 to 200 new trainees each year per 1,000 active workers in the field. This means that when a relatively full working force of 15,000 speech correctionists has been achieved, from 1,500 to 3,000 new recruits per year must be trained just to maintain the personnel supply. It is already requiring from 200 to 400 per year to maintain the working force so far achieved.

The majority of training centers today are geared to turn out trainees with basic certification only (M.A. degree or less) and most of them are likely to remain indefinitely at that level. There is a need particularly to

strengthen and expand the training centers that can prepare trainees to meet both basic and advanced certification requirements (M.A. and Ph.D. degrees). The outstanding practical dangers at the present time are to be seen in the tendency for public school administrators to employ persons to work as speech correctionists who have insufficient relevant training, and for a certain proportion of colleges to undertake professional training programs in this area without adequate clinical and laboratory facilities and without a sufficient number of instructors with acceptable qualifications. These dangers are likely to persist in some measure so long as the demand for speech correctionists substantially exceeds the well qualified supply.

It would appear that the presently available personnel might best be utilized by:

1. Encouraging the most highly qualified workers to accept predominately professional training, supervisory, and research responsibilities.

2. Encouraging workers with basic certification to accept or develop positions on the general level of public school programs in which their duties would include (a) survey and essential preliminary diagnosis, (b) individual and group therapy for the children most in need of it, (c) in-service training courses for the regular classroom teachers, plus work with them on a consultative basis to care in this indirect fashion for the milder or less urgent cases, and (d) summer clinics on a full-time basis for all speech handicapped children in the school system who can and will attend.

3. Utilization of acceptable workers with less than basic certification for positions under the supervision of certified speech correctionists.

4. Continuous expansion by speech correctionists of their cooperative working relationships with physicians, psychologists, social workers and other professional workers, so that all relevant resources may be brought more and more fully to bear on the practical problem of helping the speech handicapped.

5. The greatest possible use of aid and general cooperation by classroom teachers, parents, clergymen, youth group leaders, and other lay persons closely concerned with individual children.

In the meantime, it is especially important that scientific research be stimulated and financially supported far beyond what has so far been done. There has been a very considerable amount of research on stuttering; a survey by Elliott (*1*) indicates that over 300 graduate theses dealing with stuttering have been completed in recent years in American universities. Generally speaking, less research has been done on the other types of speech disorder. Experience with war-injured patients with aphasia has stimulated increased research on aphasia and its treatment. A few notable investigations of cleft palate and the speech problems associated with it have been done in the past few years. There is a particularly great need for research on the speech aspects of cerebral palsy, the speech problems associated with impaired hearing, and retarded speech development. Much more research than has been done is needed in order to clarify the baffling etiological backgrounds of ordinary functional articulatory disorders.

In general, with the partial exception of stuttering, the disorders of

speech have been impressively neglected from a research point of view. Diagnostic principles, examination procedures, and retraining methods have gone for the most part unevaluated in a strict scientific sense. As a consequence, it is quite likely that a considerable proportion of the funds now being spent on clinical work in speech is being wasted because the methods used in many instances are relatively ineffective, even possibly futile or harmful in some cases, or at least less adequate than they could be. In a professional field as new as speech pathology it would seem reasonable to recommend that at the very least 10 per cent of all expenditures, from public or private funds, should go for research. If those responsible for the budgets of the public schools, colleges and universities, hospitals, and large philanthropic organizations do not become more inclined to devote money to research in this field than they have been, the remaining significant alternative would appear to lie in the allocation of Federal funds to this purpose.

The seriousness of speech disorders is to be seen especially well in the problems to which they give rise. It is to be recognized first of all in this connection that in some persons, to some degree, handicapping conditions such as speech defects stimulate compensating drives which occasionally lead to very considerable achievements—or at least they appear to do so. It is clearly difficult to make sure what is cause, what is effect, and what is simply irrelevant in such cases. Does a stutterer become a star shortstop, or a top-flight salesman, *because* he stutters, *although* he stutters, or *incidentally* so far as his speech problem is concerned? Whatever may be the proper answer to such questions in specific instances, it seems well established that other effects of speech disorders are to be described in such terms as these:

1. Speech defectives appear to be retarded scholastically, and to fail to take advantage of opportunities for college training, out of proportion to expectations based on intelligence test data.

2. A speech defect tends to impair the child's relationships with his parents. The child may become less self-reliant than he would be otherwise because the parents are over-solicitous and sympathetic; he may develop a significant sense of insecurity, probably accompanied by feelings of hostility, because the parents, usually in subtle, indirect and even seemingly kindly ways, reject him in refusing psychologically to accept the speech defect; he may, in either case, or under still other circumstances, withdraw socially within the home as well as outside and so fail to achieve a normally intimate relationship with his parents.

3. In some cases, particularly those in which the basic condition is cerebral palsy or aphasia, for example, the degree to which *speech* is impaired is likely to determine to a large extent the general effect of the condition on the home and family—and on individual members of the family. A handicapped person who can speak normally or nearly so is tremendously different, as a rule, from the family point of view, from one whose speech is gravely impaired. Indeed, the degree to which the life of the handicapped member can be integrated effectively and happily into the life of the family, and the degree to which the family life may be carried on,

therefore, in a normal fashion, depends very heavily upon whether the speech function of the handicapped individual is intact.

4. In the absence of needed systematic research, probably the most defensible statement to be made on the basis of common knowledge would place the deficit in earning power brought about by the average speech defect at about 25 per cent. In many instances, of course, as in cases of severe aphasia, the loss in earning power is complete. In most cases, the earning power deficit is determined in large measure by the person's attitude toward his speech problem and his personality adjustment generally. It is a fact with reassuring implications that individuals with speech disorders are to be found in practically all walks of life and levels of responsibility. The number of stutterers, for example, who are successful professional entertainers, teachers, salesmen and industrial executives is impressive —and scientifically significant—in view of the grave handicap stuttering is to most persons who have not learned how gracefully to come to terms with it.

5. Generally speaking, so far as the individual's self-evaluation and intimate personal adjustment are concerned, a speech defect tends to be primarily frustrating and demoralizing. It is to be well appreciated that, aside from actual touch and caress, s p e e c h affords the most intimate means of personal inter-relationship for all human beings. It is the chief medium through which we all express and share our feelings, experiences, and meditations. And every speaker is affected by his own speech in ways that contribute heavily to all that we mean by individuality or personality. The need for speech, therefore, has for all practical purposes the status of a basic appetite or drive, and the frustration of it, devastating in some cases, is never without consequence. Aggression, hostility, and resentment are among our most common reactions to significant frustration, and they are to be found accordingly among children and adults frustrated in speech. These are modes of reaction, however, that do not tend to be very rewarding, especially w h e r e speech is concerned, and perhaps it is partly for this reason that the most common important reactions to frustrated speech are feelings of shame and discouragement, feelings of inferiority and insecurity, and a tendency to be shy, to withdraw from social situations, to avoid scholastic and vocational responsibilities, and so to function below par—that is, at a level below that warranted by the individual's evident potential. It is of the greatest significance that all these are reaction patterns that are avoidable. Good childhood training, the best of modern education, effective psychological counseling, and the procedures of present-day speech correction go far to prevent and alleviate such effects of disordered speech.

These, then, are some of the reasons why speech correction is important. As a matter of fact, for the many children who need it the public or private school simply has nothing else to offer that can compare in importance with speech correction. While this may not be generally appreciated, it is much too obvious to be disregarded once it has been made clear.

What is not quite so obvious is the fact that it does something to a school in a pervasive and basic sense, it does

something very fine to all the children who attend a school, it does something profoundly enriching to all the teachers and administrators in a school, to have a program in that school that makes the story of the Good Samaritan come alive every morning for every handicapped youngster in the place, that brings 'being good to others' right into every classroom with the same status as being 'intelligent' or 'good looking' or 'popular,' that makes it possible for all children to grow up in surroundings where kindness and a helping hand are taken for granted as part of the normal scheme of things.

Speech correction is important, then, not only for the essential value that it has for children with speech handicaps, but also for the good it does for all other children through the example of humanitarian service that it sets for them day in and day out—and, finally, because the educational principles that underlie the practical procedures of speech correction appear to be sound for practically all teaching purposes and for all children, handicapped or not. These principles are, in fact, the ones that would appear to define, in a general sense and for all children, education for healthy personality growth and effective democratic living. These are the main ones:

1. Effective speech correction involves meaningful exploration of the specific needs of each child, and it involves individual instruction and personal attention generally as the needs of each child require. It involves a deep respect for each child as a unique human being.

2. It involves group instruction so far as possible, because speech is *social* behavior, and speech correction—like speech in its normal forms—thrives best in a thoroughly democratic social atmosphere. It involves a deep respect for the child as a social being, as one who belongs with others.

3. It incorporates fully the time-tested laboratory finding of experimental psychology that we learn best to do that which we are most rewarded for doing—and so speech correction is carried on in such ways as to make speaking enjoyable and the improvement of speech rewarding.

4. It is based on an appreciation of the close relationship between speech and personality, and so everything possible is done by the qualified speech correctionist to improve the personal adjustment of the child, and at the same time improvement in speech itself is valued for the greater freedom it affords for personality growth.

These principles, as applied in particular situations and in various concrete ways, may be expected to make richer and more effective our educational program for all children.

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Construction Of One-Way Vision Mirrors

Martin F. Palmer

A USEFUL ITEM of equipment in a speech and hearing clinic is the one-way mirror. The commercial models are quite expensive, but it is possible to construct a satisfactory one cheaply and easily. Mirrors built in 1939 for a cost of about 85 cents each are still in use at the Institute of Logopedics.

The principle of the one-way mirror is based on light differentials. One side of the mirror is brightly lit and the other side is relatively dark. Light falling on the mirrored surface reflects into the eyes of individuals in the brightly lit room in such a way that they are unable to perceive items beyond the light refracting particles of silvering compound. On the dark side the individuals are able to see past these particles because there is less reflection from the surface. The only problem is to distribute mirroring compound evenly upon glass in such a way that the particles will be dispersed widely enough for light rays to go past them and at the same time close enough to form a uniform reflecting surface from any bright light in the room. This sounds more difficult to produce than it actually is.

Any mirror maker working in an ordinary glass company can make the mirrors by following these instructions: Two sheets of glass are cut from the thinnest and cheapest stock. They must be exactly equal in size. One of the glass sheets is laid on a table over boards on supporting stock so that it can be lifted later. The mirror maker takes his regular spray gun and gives one pass over the glass as fast as possible with regular mirror compound, spreading it evenly and thinly. Only one coat of compound is applied. It may take some experimentation for him to be able to spread the mirroring compound evenly with only one pass across the glass, but no difficulty has been experienced.

Around the edge of the glass and inward about a quarter of an inch the mirroring compound is wiped free and two coats of ordinary orange shellac are applied. Then on the freshly mirrored surface the second pane of glass is lowered directly without smudging. The technician must be very careful to lay the second glass directly down on the first without adjusting it after it is placed. The shellac is allowed to set and the edges are then bound with ordinary white adhesive tape which extends inward a quarter of an inch or more. The adhesive tape itself is then given a coat or two of orange shellac. The mirrors are installed in the wall or door with moulding on either side of sufficient size to hold them firmly in place and to cover the adhesive tape bound edges.

At the time this process was invented some criticism was leveled at it from the standpoint that such mirors would rapidly oxidize and lose their effectiveness. The use of shellac at the edges and on the adhesive tape is to prevent oxidation by a tight seal. In 12 years use, no difficulty of this sort has been observed.

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An Experimental Approach To Expectancy And Anxiety In Stuttering Behavior

George J. Wischner

A PREVIOUS PAPER (*40*) has considered a preliminary theoretical analysis of the problem of stuttering behavior within a reinforcement learning frame of reference (*9, 19, 28*). Preliminary to the theoretical presentation, the broad outlines of a program of research designed as an experimental approach to the problem of stuttering as learned behavior were described. Fruitful as points of departure for such a program have been prior studies in the field concerned with (1) the adaptation phenomenon in stuttering behavior,[1] and (2) the anticipation phenomenon and the roles of expectancy and anxiety in stuttering behavior. The present paper is concerned primarily with the latter variables.

Expectancy and Anxiety in Stuttering Behavior

In the field of stuttering, the words 'expectancy' (expectation), 'anticipation,' 'fear' and related terms have been employed by different investigators, if not always synonymously, at least in a context suggesting that the referents of these terms are highly interrelated. The present paper has two major purposes: (1) to review briefly the work on expectancy and anxiety in stuttering behavior in an attempt to clarify the manner in which these and related concepts have been used by workers in this area; (2) to consider various aspects of an experimental approach to the expectancy and anxiety variables in stuttering behavior.[2] Relevant preliminary studies have already been completed by the writer and others and will be discussed at appropriate points in this

[1]Stuttering adaptation refers to the progressive decrease in frequency of stuttering with repeated readings of the same material under constant stimulating conditions. Representative studies dealing with this phenomenon are those by Johnson and Knott (*23*), Shulman (*33*), Harris (*18*), Johnson and Inness (*22*). A systematic discussion of the course of stuttering adaptation, the variables of which it is a function, and an attempt to integrate this and related phenomena within reinforcement learning theory have been presented by Wischner (*39, 41*).

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[2]This constitutes one aspect of a broader program of research on stuttering behavior and learning.

paper. It has also been possible, by reinterpreting or reworking them, to utilize data previously reported in the literature or otherwise made available to the author.

The Expectancy or Anticipation Phenomenon. For Johnson and his students (*20, 24, 25, 26*), the anticipation phenomenon refers to the empirical relationship between two classes of *behavioral* responses made by a stuttering subject to a stimulus word. The subject first indicates, before saying a word, whether he expects (anticipates) difficulty with the word and then makes the speech attempt. Expectancy then is simply defined in terms of the signaling operations the stutterer is instructed to make before speaking. These operations have included a tapping signal or marking words on which stuttering is expected during the silent reading of stimulus material. The expectancy phenomenon is the finding, corroborated in several studies, that there is a substantial relationship between expectancy of stuttering and speech performance. That is, the stutterer can predict whether or not he will stutter on a word. The major findings of studies of expectancy, as defined here, are as follows:

1. The stutterer is able to anticipate the words on which he will have difficulty with a degree of accuracy greater than can be accounted for by chance. Knott, Johnson and Webster (*26*) report that stuttering occurred on 94 to 96 per cent of the anticipated words. Of words on which no difficulty was anticipated only 0.4 to 3 per cent were stuttered.

2. The stutterer tends to experience difficulty on anticipations although the actual reading of the material is performed from one to seven days after the anticipations have been indicated (*25*).

3. In an experiment by Johnson and Sinn (*24*), 98 per cent of the stuttering was eliminated when subjects were instructed to omit words on which they expected to stutter. There also appeared to be a strong tendency for expectation of stuttering to occur on words which had been previously stuttered.

4. Johnson and Ainsworth (*20*) studied the reliability of anticipations by having subjects indicate anticipations for material on two separate occasions. The time interval between two inspections of the same passage varied from two to six weeks. They report that 'to a marked degree, expectation of stuttering (as here defined) occurred during the second reading on the same words on which it had occurred during the first reading.'

5. Milisen (*27*) has emphasized that there is no one-to-one correspondence between anticipation and the occurrence of the stuttering response. There is a small percentage of instances where expectation is not correlated with stuttering behavior and difficulty may be experienced with words on which no trouble is anticipated.

6. Van Riper and Milisen (*37*) report that stutterers can predict not only the moment of stuttering but also its duration in a situation where they indicated whether they expected to have a medium, long, or severe moment of difficulty.

Physiological Factors and Expectancy. For Van Riper (*35*), expectancy is more than a descriptive label designating a behavioral characteristic of stutterers under specified experimental conditions. Van Riper has been particularly interested in the physiological correlates of the expectancy phenomenon in stuttering behavior. Expectancy, says Van Riper, is no vague

abstraction. It 'consists of tiny rehearsal movements and increases of tonus of the musculatures. . .' In a study of the thoracic breathing of stutterers during the expectancy period and during overt stuttering, Van Riper (*36*) found that the Inspiration-Expiration duration ratio existing immediately subsequent to the exposure of the word could differentiate words on which stuttering was expected from those on which the subject expected no difficulty.

Van Riper and Milisen (*37*) have abstracted observations from early studies by Fletcher (*12*), Robbins (*30*), and others to demonstrate the variety of physiological and motor correlates of stuttering expectancy that has been observed. These include changes in pulse rate, vaso-constriction, and electrodermal response, increases in brain volume, neck rigidity, eye closing and occasional action current abnormalities.

Despite the different levels, behavioral or physiological, on which expectancy phenomena have been studied, there is, nevertheless, a high degree of agreement as to the importance of the period immediately prior to the moment of stuttering. From the results of one study, Johnson and Ainsworth (*20*) concluded:

> Any theory of stuttering which does not involve an adequate account of expectation of stuttering does not, by virtue of that fact, involve an accurate account of stuttering.

Van Riper (*35*) speaks of the two most prominent features of the stuttering experience as the expectancy and the experience of speech block. In the article written with Milisen (*37*), the following introductory paragraph appears:

> Although investigations of the role of fear or anticipation of a stuttering block would seem to provide the means for important contributions to our knowledge of the disorder, there are few such studies to be found in the literature.

Preparatory Set. For Van Riper (*35*), preparatory set is closely associated with the expectancy process. It is defined as 'a pre-stimulus, neuromuscular adjustment which selects, determines, and controls the response to the expected stimulus.' It is the preparatory set which somehow determines the form of the stuttering behavior. Since different individuals stutter in different ways, presumably there are individual differences as to type of preparatory set.

According to Van Riper, the preparatory set in stuttering is analogous to the runner 'on his mark' in a footrace, waiting for the pistol shot. In stuttering there is usually (1) the specific expectancy of difficulty on a certain word aroused by certain cues; (2) evidence for this expectancy is defined in terms of rehearsal movements and changes in tonus of the musculatures used by the stutterer during the overt speech attempt; (3) this expected signal, the feeling of block, with the resulting postural and musculature changes, cause the preparatory set to be released and the characteristic manner of stuttering is then manifested.

Fear and Anxiety. It appears to the present writer that there has been little, if any, precise use of these terms with reference to stuttering. In the studies summarized above there may be found a tendency to identify expectancy and fear. Van Riper (*35*) talks of 'fear of stuttering which seems to beget and precipitate a great many of the blocks.' The stutterer comes to dread certain words and sounds. Van Riper also defines fear as being 'largely the expectation of

the unpleasant,' a definition that comes close to that of Freud (*13*).

The words 'anxiety,' 'apprehension,' 'fear' and 'dread' appear in many so-called theories of stuttering, although they have been used largely in a descriptive or clinical, rather than in any systematic theoretical sense. For example, Blanton (*17*) speaks of fear states in the stutterer as well as anxiety and guilts. Bluemel (*17*), referring to what he calls the secondary stage of stammering, states that this stage results when the speech situation arouses fear and panic. For both Coriat (*17*) and Robbins (*17*), at least in the reference cited, and Fenichel (*11*) stuttering is a psychoneurosis, and interpreted in the psychoanalytic framework this would imply an anxiety mechanism in stuttering.

Fletcher (*17*), who views stuttering as a pathological social response, writes the following:

> The principal factors which enter into the causation of this form of serious social maladjustment are fear, dread, anxiety, worry, inferiority feelings, and similar attitudes of mind, all of which have their genesis in *specific experiences.* It is not fear in general, or dread or anxiety or worry in general, but fear, dread, worry, and anxiety *experienced in anticipation of the necessity to speak under certain definite conditions* which sets off the stutterer's pathological reactions.

In his outline of a semantic theory of stuttering behavior, Johnson (*17*) says that the 'overt behavior is seen as the tense, anxious hesitancy with its many complications which we call well developed stuttering.'

It may be noted that practically every worker in the field, including those who espouse physiological factors as basic to stuttering, recognizes the need for consideration of emotional—fear and anxiety—reactions in the understanding and treatment of the stuttering problem.

General Anxiety and Specific Anxiety in Stuttering Behavior

Van Riper (*34*) has distinguished two kinds of expectancy in stuttering behavior. These are *generalized expectancy*, which is experienced when the stutterer finds himself in a situation similar to those in which he has previously stuttered, and *specific expectancy*, which is aroused by cues associated with specific words dangerous for the stutterer.[3] This differentiation, it is to be noted, is based on the stimulating conditions which arouse the particular kind of expectancy and there is no necessary implication that the expectancy or fear states instigated by the two classes of stimuli are fundamentally different. In one instance the stimulus is a specific word, or cues associated with it; in the other it is a general situation.

The present writer is of the opinion that available experimental behavioral data tend to support the differentiation between the two kinds of expectancy suggested by Van Riper. The evidence for the *anticipation* or *expectation phenomenon* in stuttering behavior discussed earlier, would appear to be directly related to Van Riper's *specific expectancy*.[4] Experi-

[3]Concerning the relationship between these two kinds of expectancy, Van Riper says only that the generalized expectancy causes the individual to engage in 'an actual search for difficulty.' Why the stutterer may 'find' more difficulty (dangerous words) in one situation than another, that is, why he will stutter more in one situation than another, is not discussed by Van Riper.

[4]Additional support for the view that expectancy of stuttering may be instigated by specific words and the cues associated with them, is to be found in the consistency effect in stuttering and studies by Brown (*2, 3, 4, 5, 6, 7, 21*). The consistency effect is the tendency for loci of moments of stuttering to remain constant with repeated read-

mental support for *general expectancy* is to be found in a study by Porter (*29*). This investigator had Ss read a different 500-word passage in each of eight different situations, judged to be of varying difficulty for the stutterer. Prior to each reading, Ss estimated the percentage of words on which they expected to stutter in that particular situation. Porter found that Ss' estimates of how much they expected to stutter varied in the same direction as the actual number of words stuttered, although there were some absolute discrepancies between stuttering frequency and anticipated frequency in a given situation.

In accordance with the evidence for what may now be termed a *specific expectancy phenomenon* and a *general expectancy phenomenon,* and following Van Riper, the present writer has found it useful to speak of *general situational anxiety* and *specific word anxiety*.[5] As for Van Riper, these terms are defined by the antecedent conditions which give rise to them. Situational anxiety arises from a fear of speaking as such, and the stimuli which instigate it are non-verbal in character and may include general speech situations of all kinds and associated cues such as: the nature of a specific audience (for example, sex, number, age, relationship of members to the stutterer such as parent, teacher or minister) and other physical characteristics such as the presence of a telephone or microphone. Stimuli that instigate specific word anxiety are wholly verbal in character and include specific words and cues associated with them. The latter include such items as formal word characteristics (beginning consonants and grammatical function) or meaning. Subsequent discussion of experimental data will indicate the usefulness, at least tentatively, of distinguishing between these two types of anxiety.

The distinction between general situational anxiety and specific word anxiety raises several questions concerning the relationship between stuttering behavior and these two kinds of anxiety. (1) What is the effect on stuttering behavior when situational anxiety is varied and specific word anxiety is held constant? (2) What is the effect on stuttering behavior when specific word anxiety is varied and situational anxiety is held constant? (3) What is the effect on stuttering behavior when both situational and specific word anxiety are varied simultaneously?

Data relevant to the first and third questions have been found by the present writer in earlier studies by Shulman (*33*), Porter (*29*), and Hahn (*16*). These investigators have been concerned in general with the effect on stuttering behavior of variations in the audience, or, as they have termed it, 'social factors' or 'the social complexity' of the oral reading situation. An experiment performed by the present writer provides data relevant to the second question.

In the discussion that follows, it is assumed that any change in a verbal stimulus complex, such as a reading passage or word list, following an initial experience with that stimulus, results in a change in specific word anx-

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ings of the same material. That is, stuttering tends to occur on words stuttered in previous readings of the same material. Evidence for such an effect is to be found in studies by Johnson and Knott (*23*), and Johnson and Inness (*22*). Brown has offered evidence to show that word length, beginning consonant, position of word in sentence, and grammatical function, may serve as cues for stuttering behavior.

[5]As used here, the term 'anxiety' has the status of a theoretical construct or intervening variable (*31, 32*).

iety. Any change in a situation following exposure to that situation, effects a change in general situational anxiety. Different situations may instigate different degrees of situational anxiety.

Stuttering Behavior as a Function Of Progressive Variation in General Situational Anxiety

An experiment by Shulman (*33*) bears on the relationship indicated in Question 1 above. This investigator had stutterers read a different 500-word passage five successive times in each of two conditions. In a control condition Ss read a 500-word passage to E alone. This, it is to be noted, represents the optimum conditions for obtaining the stuttering adaptation phenomenon. In an experimental condition, stutterers also read a passage five successive times but on each successive reading the audience was increased by one person, making an audience of five by the fifth reading.

Shulman's results are reproduced in the left half of Figure 1. The solid line pictures the frequency of stuttering in the control condition. The dotted line shows the relative effect of increasing the audience by one on each successive reading. It seems clear that variation of audience size in the manner indicated results in a relative increase in the level of stuttering frequency as compared with the control condition. The progressive decrease in stuttering frequency with repeated reading of the same material, despite variation in the audience variable from reading to reading indicates that stuttering adaptation does occur in the experimental condition, although the rate of fall of stuttering frequency is retarded relative to that for the control condition.

Stuttering Behavior as a Function Of Varying Simultaneously General Situational and Specific Word Anxiety

Data bearing on the third question, which concerns the effect on stuttering behavior of varying situational and specific word anxiety simultaneously have been culled from earlier experi-

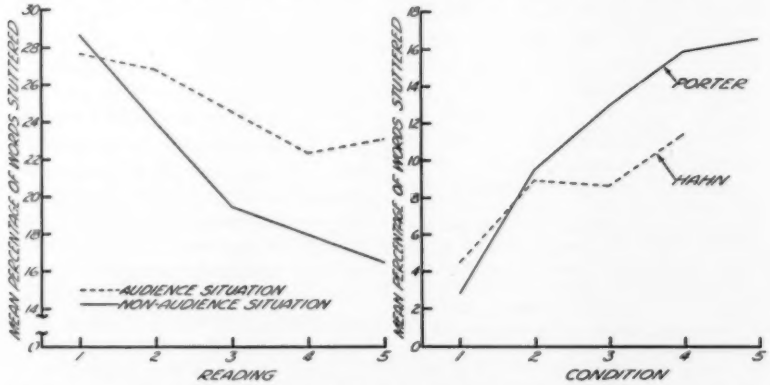

FIGURE 1. The graph on the left, reproduced from Shulman (*33*), shows the relative effect on stuttering behavior of increasing situational anxiety on each successive reading of the same material. The curves on the right illustrate the effect of varying simultaneously both general situational and specific word anxiety. The latter curves are plots, by the writer, of data abstracted from Porter (*29*) and Hahn (*16*).

ments by Porter (*29*) and Hahn (*16*). Porter manipulated both audience size and reading passage on each reading. Thirteen Ss read a different but presumably equivalent 500-word passage once in each of five different oral situations. In Condition 1, Ss read while alone in a room, with E in an adjoining room recording stuttered words heard through a concealed microphone system; in Condition 2, there was an audience of one listener, E; in Condition 3, there was an audience of two, and in Conditions 4 and 5, the audience was increased to four and eight listeners respectively.

Hahn had 52 stutterers read a different 500-word passage in each of four conditions. It is of considerable interest that identical words, telling the same story were used in construction of passages employed, but word and paragraph order varied from passage to passage. The four situations in the order presented by Hahn were: (1) reading aloud to self; (2) reading aloud to audience of one E known to be in the room but seated behind a screen; (3) reading directly to E; and (4) reading to a group of stutterers and non-stutterers ranging in size from five to ten individuals.

The present writer has plotted the results of these two experiments based on data reported by the original investigators in the right half of Figure 1. The solid line is a plot of Porter's data in terms of mean percentage of words stuttered in each of the five conditions. It is readily apparent that varying both audience size and verbal material simultaneously, results in a progressive *increment* in the frequency of stuttering behavior. The increment tends to grow smaller with geometric increase in audience size and the curve appears to be reaching a maximum at eight listeners.

The data for Hahn's study are represented by the broken line in the right half of Figure 1. This plot again indicates a trend for the frequency of stuttering behavior to increase when audience and word factors are varied together.

The absolute difference between Hahn's and Porter's results may be due to one or more factors which differed for the two experiments. Relevant in this connection, would appear to be the greater orderliness with which Porter varied the audience factor and the particular construction of Hahn's verbal material. It may be noted that Hahn's data for Conditions 2 and 3 indicate there is little difference between reading to one unseen listener, known to be present, and reading directly to this listener. If we compare the results for Hahn's first two conditions with those of Porter which, it will be recalled, were similar, it will be seen that there is relatively little absolute difference in the results for the two experiments.

In summary, Shulman's data show that when word stimuli are held constant and audience size is increased progressively by one, there is a progressive *decrease* in the frequency of stuttering behavior with successive readings, although the absolute amount of stuttering is higher than that of a control condition in which both verbal and audience factors are held constant. The data abstracted from Porter and Hahn point rather to a progressive *increment* in the percentage of words stuttered when audience size is increased simultaneously with variation in the verbal stimulus complex.

Stuttering Behavior as a Function Of Variation in Specific Word Anxiety with Situational Factors Held Constant

A study by the present writer is concerned with Question 2, above.

Subjects and Procedure. Fourteen adult stutterers participated under two conditions. In Condition 1 Ss read the same 200-word passage five successive times to the E. In Condition 2 they read successively each of five different 200-word passages once to the E. Approximately 24 hours elapsed between conditions and there was a five-second interval between successive readings within each condition. The specific passage used in the first condition and the five passages and the order in which they were to be read in the second condition were assigned to each S on the basis of a table of random numbers. With respect to order of conditions, Ss were also assigned at random and order was counterbalanced so that for half the Ss Condition 1 occurred first and for the remaining half Condition 2 occurred first. Instructions informed Ss at the beginning of each session whether they were to read the same passage or a different passage at each reading.

Results. The basic findings are provided in Figure 2 which is a plot of the mean number of words stuttered by the group during each reading in each condition. It is clear that the curves for the two conditions are quite different. That for Condition 1 is typical of the curve of stuttering adaptation obtained with repeated readings of the same material under constant conditions.

The curve for Condition 2 shows several interesting characteristics. For the first two readings it closely follows that for Condition 1 and then diverges steadily with each remaining reading. That the curves for the two conditions should begin at approximately the same point is to be expected, and the *t*-value of .82 between the first readings in both conditions indicates that the randomization and counterbalancing procedure were effective in eliminating bias which may have otherwise been introduced by passage differences or practice effects. The drop for the second reading of Condition 2 is not so readily explainable. That it is a reliable drop is indicated by the *t*-value between the first two readings for this condition of 2.75 which is beyond the 2% level. This *t*-value is very close to that of 2.70 for the difference between corresponding readings in Condition 1.

As has been noted, after the second reading, the two curves diverge steadily, and at the fifth reading the difference between corresponding points approaches significance at the 2% level, with a *t* of 2.46. Does the progressive rise after the second reading in Condition 2 represent a real trend? The *t*-value of 2.34 between reading 2 and reading 5 in this condition is

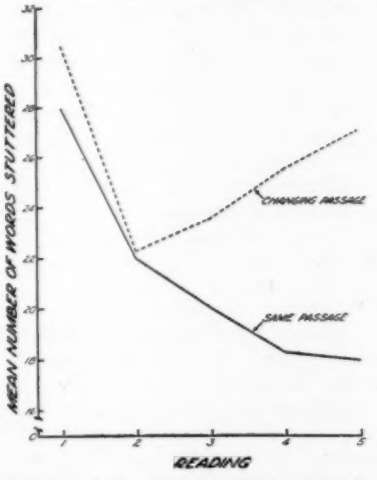

FIGURE 2. The effect on stuttering behavior of varyi: g specific word anxiety in successive readings. The solid line represents the usual stuttering adaptation curve obtained with successive readings of the same material. The dotted line shows the relative effect of changing passages at each reading.

significant beyond the 5% level and at the fifth reading the curve is still rising. Moreover, the difference between reading 1 and reading 5 is not significant, a result which indicates that the frequency of stuttering behavior on reading 5 is approaching the level of that of the very first reading in this condition. Under the conditions of the present experiment, at least, there is evidence to suggest that the increase in frequency of stuttering moments after the second reading during the successive readings of new passages, may be a real trend.

Discussion. The progressive rise in the second half of the curve for Condition 2 is seemingly incompatible with the results of studies which have shown an over-all decrease in stuttering frequency with continued reading of changing material. Donohue (*10*), for example, who had subjects read continuously changing material over a three-hour period, reported a gradual decrease in stuttering as from the first to the last half-hour period. The difference between the results of this study and those of the present experiment, it is believed, may be due partly to the size of word segment employed as a basis for scoring. Donohue's data were presented in a way that it was possible to calculate the frequency of stuttering behavior for each of the first five 200-word segments. Each such segment would then correspond to each of our 200-word passages. The mean number of words stuttered by 10 Ss in each 200-word segment is as follows: 17.8, 11.8, 9.1, 14.7, and 14.5. The general correspondence of these data with our own results is rather striking, particularly with respect to the large drop from the first to the second segment. To be sure, stuttering frequency also drops slightly for the third segment, following which it tends to increase, although again, it is to be noted, this increase is not as regular as is that in the present study. One probable important variable in the present investigation is the effect of beginning a new passage each time, a factor which was not operating in the Donohue study.

At present it can only be speculated as to the significance of the initial drop in stuttering frequency for Condition 2 in the present study and in the Donohue data reported above. A reasonable hypothesis is that any speech situation initially arouses a certain degree of situational anxiety. This anxiety drops quickly if the situation remains constant. If words are varied, however, the influence of specific word anxiety may then assert itself. On the basis of such a hypothesis, at least one of the mechanisms underlying the stuttering adaptation phenomenon may be this quick initial drop in situational anxiety.

The findings of the present study and the earlier discussion of the Shulman, Hahn and Porter experiments suggest that specific word anxiety, maintained by continuously varying the word stimulus complex, is a relatively powerful factor in stuttering behavior.

Stuttering Frequency and Adaptation as a Function of The Degree of Situational Anxiety

A recent study by Dixon (*8*) provides basic data relevant to the problem of situational and specific word anxiety. Twenty-four Ss read a different passage five times in each of three situations: (a) to the experimenter, (b) to an audience of five people, and (c) over a telephone. These three situations were assumed to be capable of inducing different amounts of situa-

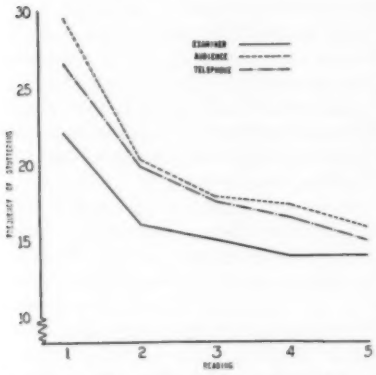

FIGURE 3. The mean number of words stuttered on each of five successive readings of a passage in three situations presumed to vary in initial level of general situational anxiety. Reproduced from Dixon (*8*).

tional anxiety. Subjects reported for three experimental sessions spaced approximately 24 hours apart.

Figure 3, reproduced from Dixon (*8*), is a plot of the mean number of words stuttered on each reading in each condition. As judged by the heights of the curves, the order of difficulty of the situations is audience, telephone, examiner.[6] The three curves begin at different heights and maintain their positions relative to one another throughout the number of readings employed. Dixon found that the differences between the examiner situation and each of the other two conditions on the initial reading were statistically reliable. That between the audience and telephone situation for the same trial was not significant.

Of special interest is the finding of a significant adaptation effect within each condition. That situational anxiety is a variable which affects stuttering adaptation seems clear. The primary function of the factor of situational anxiety appears to be to fix the height of the adaptation curve. But within each anxiety level an adaptation effect is present. Whether the curves would cross with further readings or whether each curve would eventually reach its own particular level is not clearly evident from Dixon's study. In this connection it may be noted that none of the differences between fifth trial points is statistically significant.

An Expectancy Adaptation Phenomenon in Stuttering Behavior

The relatively high correlation between expectancy of stuttering and overt speech performance suggests that certain general relationships which will be found to hold for overt speech may also hold for sheer expectancy of stuttering. A preliminary study by the present writer aimed to investigate the expectancy phenomenon as such. More specifically, answers were sought to the following questions: (1) Is there an *expectancy adaptation phenomenon* similar to the stuttering adaptation phenomenon? (2) Should expectancy adaptation be demonstrated, what is the influence of varying the time interval between successive inspections of the same material?

Subjects and Procedure. Data were obtained for 21 male stutterers who were enrolled in the summer speech clinic at the University of Iowa. They ranged in age from approximately 12

[6]It had seemed a reasonable assumption that the telephone situation would prove more difficult for the majority of subjects, but it became evident, early in the experiment, that the particular telephone situation used was not suitable. Circumstances made it necessary to employ an engineering field telephone apparatus and most subjects commented on the artificiality of the setup as compared with an actual telephone situation.

to 26 years with the mean age at 18 and the median age at 16 years. The schedule of remedial work required that Ss attend a group meeting daily at 2 p.m. This made it possible to employ a group approach.

The general procedure consisted in having Ss read a 250-word passage silently, underlining words on which they expected to stutter. At no time during the experiment did Ss read aloud any of the material. In Condition 1, which was administered first, Ss inspected the same passage once on each of five successive days (24-hour intertrial interval). Condition 2 was given four days following the completion of the first condition. Condition 2 was completed at one sitting during which Ss inspected a second passage five successive times with a negligible interval between successive silent readings of the material (zero intertrial interval).[7]

The specific procedure for Condition 1 provided that at the beginning of the hour a mimeographed copy of a reading passage be placed face down on the desk of each S. The following instructions were repeated at each of the five successive daily sessions.

> We are interested in finding out how well you are able to predict on which words you will have difficulty in an oral reading situation. Think of the situation as that of standing and reading a passage before a group. In this reading you would not make any undue effort to avoid stuttering, to 'fake,' or to use any method of voluntary nonfluency. You would be reading at your normal rate, letting yourself go and stuttering as much as you would ordinarily. When I say, 'Ready,' turn over the paper and begin to read the passage silently to yourself. Underline each word on which you think you will stutter should you be called upon to read the material orally before a group. Do not re-read the passage. Read it only once, underlining the words on which you think you will stutter. As soon as you have finished, turn the paper over to indicate that you are done. Any questions? Go ahead!

For Condition 2, five copies of a passage were stapled together and placed face down on the desk of each S. The first part of the instructions for this condition were the same as those for Condition 1. The modified instructions were as follows:

> The material before you consists of a number of copies of the same passage. When I give you the signal turn the top sheet and begin to read the first copy silently to yourself. Underline each word on which you think you will stutter should you be called upon to read the passage orally before a group. Do not re-read the material on this page. As soon as you have finished the first copy turn the page under like this (demonstration) and go on to the second copy, underlining the words on which you think you would stutter on this reading. Do the same thing with the remaining copies. Do not turn back to any of the copies you have already marked. Do you have any questions? Begin!

Observation by proctors during each session attempted to insure that Ss followed instructions. At the end of the experiment Ss were asked to answer, in writing, certain questions which will be indicated in the discussion of results.

Results. The basic findings are given in Figure 4 which is a plot of the mean frequency of anticipations for each inspection trial in the two conditions. The plot for the zero interval condition appears to reflect a relatively orderly process. There is a progressive decrement in number of anticipations with successive inspections

[7] A third condition, in which the time interval between successive markings was one week, was begun, but was not completed because of irregular attendance and an outbreak of mumps which necessitated suspension of clinic activities. Available data for this condition indicated a trend similar to that for Condition 1.

of the same material although the slight rise from the fourth to the fifth trial should be noted. It is to be observed that the difference between inspections 1 and 5 for this condition is not quite significant at the 5% level, the *t*-value being 1.91. That between trials 1 and 4 is significant at this level with a *t* of 2.14. The results for the 24-hour interval suggests no specific trend. The initial rise and the other irregular variations are attributable to chance, none of the differences between any of the points being statistically significant.

Even casual inspection of Figure 4 indicates a marked difference between the two conditions. It is noteworthy that both curves begin at about the same level but after the first inspection trial the trends for the two conditions are clearly different. A test of significance of the difference between fifth trial points yields a *t*-value of 2.59, which is significant beyond the 2% level.

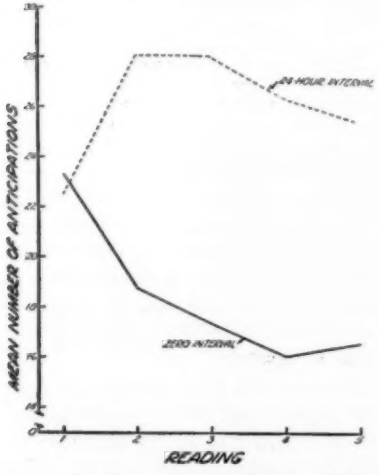

FIGURE 4. The mean number of anticipations marked by Ss during five successive inspections of the same material in Condition 1 (24-hour interval between inspections) and Condition 2 (zero-interval between inspections).

The answers to the questions asked at the conclusion of the experiment point up some of the factors which underlie the expectancy phenomena. They also would appear to indicate that Ss were able to follow instructions adequately and that they made their judgments on the basis of what appear to be relevant factors in this situation. Below are given the responses of various individuals to the questions. These appear to be representative of the reactions of the group.

1. What type of group did you visualize as you read the passage silently?

A group similar to a class group; No particular group. Just a vague sea of faces; Reading to the clinic class; . . . Reading before a large group of people who could all talk.

2. Did you remember what you marked previously or did you view each reading as a separate situation?

I did remember some words I marked previously; I considered the situation as of the present; I viewed each situation as a separate situation; I viewed them separately. I didn't try to remember what I put down yesterday; Marking as of now, possibly certain words were of memory.

3. What made you think you would stutter on certain words?

Partly because of previous experiences and others just from present anticipation; A 'funny' feeling I had in my throat as I read as if aloud to myself; I stutter on some while reading to myself and I usually stutter on starting; I know which words are hard for me—I just had a feeling I would stutter on the words; Impossible to explain. Perhaps if I felt a little reaction when I saw the word.

4. Do you think you marked more or less or about the same number of words each time?[8]

[8]Inspection of the individual records revealed some marked discrepancies between

About the same number; Tendency to mark same amount but am sure it varied from day to day; It varied with how I felt and how much I felt I stuttered that day; More words each time; I think they decreased.

5. Do you think you tended to mark the same words from day to day?

I believe I did have tendency to mark same words — particularly 'Redwood'; Some, yes.

Discussion. The results of this study suggest that under conditions similar to those which yield the stuttering adaptation phenomenon, one may also obtain an expectancy adaptation phenomenon. In a situation in which Ss never read the material aloud but only marked the words on which they expected to stutter were they called upon to read it orally, the frequency of anticipated words (markings) decreased progressively with successive inspections of the same material. The course of this decrement resembles very closely the course of decrement in overt stuttering obtained with successive oral readings of the same material.

That expectancy adaptation may be some function of the time interval between successive experiences with the same material is suggested by the differences in the curves for the two conditions employed in the present study.[9] It would be necessary to repeat the present experiment with time intervals intermediate between those employed in order to determine whether such a relationship obtains in the case of expectancy adaptation.

individual answers to this question and the actual results.

[9]Attention is called, in this connection, to Shulman's report that stuttering adaptation tends to be greater, the shorter the time interval between successive readings of the same passage.

If the expectancy adaptation phenomenon obtained under the conditions of the present study can be corroborated by further investigation and can be demonstrated to be as stable as the stuttering adaptation phenomenon then there suggests itself a program of experimentation on expectancy adaptation which parallels that described elsewhere by the writer (*41*) for stuttering adaptation.

Some Further Functional Properties of Stuttering Anxiety As Related to Learning

Is anxiety in stuttering unique or does it bear a relationship to anxiety as it has been studied in other experimental contexts and to other behavior assumed to be driven by anxiety motivation? Certain studies suggest that stuttering anxiety, at least in specified experimental situations, has certain functional properties which are similar to those assumed for other kinds of experimentally manipulated anxiety. The stimulus for these particular investigations has derived largely from the experimental work on anxiety by learning psychologists (*9, 28*).

Experiments bearing on this important question have been completed by Goss (*15*), Baron (*1*) and the writer (*38*). Goss generally has been concerned with temporal factors in stuttering anxiety and has provided evidence suggesting that there is a gradient of specific word anxiety. Baron has investigated the hypothesis that stuttering anxiety would affect eyelid conditioning in a direction to be predicted on the basis of a summation theory of drive (*19*). The assumptions underlying these studies and the general nature of the findings have been summarized in a previous paper by the present writer (*40*).

In a more recent experiment, Goss (*14*) was concerned with the possibility that stuttering anxiety and behavior might be conditioned to a temporal interval. The procedure included a pre-test during which a danger signal (light) was followed at varying time intervals (4, 8, 12, 16 or 20 seconds) by a word to be spoken immediately following exposure. The results for this portion of the study indicated that stuttering frequency increased as a direct function of the time interval between warning signal and word exposure. Following this pre-test, Ss were given 160 additional trials but now the time interval between light and word was held constant at 12 seconds. A post-test, similar to pre-test was then given. It was found that the frequency of stuttering during the post-test, when compared with the initial test, had dropped off at all time intervals except the 12-second condition, at which it remained approximately constant.

The writer (*40, 41*) has offered several hypotheses about the mechanisms that may be operating to reinforce and perpetuate maladaptive behavior such as stuttering. Data bearing on one of these has been reported in a recent paper (*38*). Stated briefly, the hypothesis assumes that a feared word arouses anxiety-tension and that completion of the stuttered act is accompanied by reduction of anxiety with consequent reinforcement of the stuttering behavior. Thirty-three Ss in two university clinics were given the following simple instructions: 'Draw whatever you think most adequately represents your behavior immediately before, during, and after a moment of stuttering.' Despite the individual differences in choice of content, the drawings revealed a strikingly similar series of events in all Ss. Both manner of representation and language used by Ss identified rather clearly a cycle of events encompassing the moment of stuttering which appeared to be in line with the hypothesis. There was progressive mounting of a tension state followed by a reduction in this state upon completion of the stuttering act.

To the writer, studies of the kind described in this section, would appear to be of the utmost importance. They not only contribute to our understanding of stuttering, but also provide data related to anxiety and to other kinds of maladaptive or non-integrative behavior. Stuttering is readily available and quantifiable. It seems to provide an unusual opportunity for the experimental study of the mechanisms underlying maladaptive behavior and for its ultimate integration within a general behavior theory.

Summary

This article is concerned with the role of expectancy and anxiety in stuttering behavior. Following an analysis of the way in which these and related terms have been used by workers concerned with this problem, various aspects of an experimental approach to expectancy and anxiety variables in stuttering are considered. A final section describes several studies concerned with certain functional properties of anxiety and their relation to other kinds of fear and anxiety as they have been investigated in the learning laboratory. It is stressed that stuttering behavior, by virtue of its availability and quantifiability, provides an excellent opportunity for the study of anxiety, not only as it operates in stuttering, but also as it functions in other forms of maladaptive behavior.

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Parental Domination In Stuttering

John P. Moncur

IN RECENT YEARS both empirical and experimental evidence have revealed that certain adverse environmental stimuli seem to be intimately related to stuttering. Johnson (*4*) and his followers believe that there are specific conditions in the environment which can cause stuttering, holding that the diagnosis and labeling of the repetitions in a child's speech as stuttering, coupled with over-anxiousness regarding his efforts to speak (with subsequent correction), are primary factors in the onset and development of this speech disorder. On the other hand, Glasner (*3*) disagrees with the concept that stuttering has its genesis in any one environmental experience, saying: 'No specific emotional or environmental factor produces stuttering with any significant regularity.'

In view of this apparent contradiction, one might well ask the question: 'Is there a syndrome of environmental factors which consistently seems to cause or aggravate stuttering?' The author, in a recent investigation of environmental factors differentiating stutterers from non-stutterers (*9*), found a wide range of differences between his two groups of children. It was concluded from this study:

> If there exists one causal factor which may account for the manifold differences discovered between the experimental and control group with regard to adverse environmental influences and to which all other unfavorable factors are subordinate, it may be that the parents of the stuttering children are (as a group) dominant parents.

While it was not possible at that time to study in detail the findings in terms of the dominant parent, the writer has since had the opportunity to analyze the data obtained from the original study from the standpoint of parental domination in its various manifestations. A description of the earlier study is as follows:

> The investigation was an attempt to determine whether or not there were differentiating factors in various aspects of the environments of two groups of kindergarten and first and second grade children matched according to age, sex, school placement, and residential area, but differing in that one group was comprised of subjects whose speech could be diagnosed (in a clinical sense) as stuttering, while the other group consisted of children whose speech could be diagnosed as normal.
>
> The general procedure involved the administration of a specially designed interview form (comprised of 330 items) to a group of mothers of stuttering children and a group of mothers of non-stuttering children. Information was obtained from these rapport-type interviews regarding the basic needs of the child, the symptomatology of maladjustment, certain specific training areas, speech development and environment, and selected adverse environmental influences. Since the study involved the use of pair-matched groups, a chi square test for correlated samples was applied to the data.
>
> The stuttering group was comprised of 42 boys and 6 girls, ranging in age from

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62 to 98 months, and the non-stuttering group consisted of 42 boys and 6 girls, ranging in age from 65 to 95 months. The matching according to sex and school placement was complete and exact; each pair was matched within three months as to age; and residential area was approximate. The children were made available by the Los Angeles School System, the Beverly Hills School System, the Burbank School System, and the U. C. L. A. Speech Clinic.

Before discussing dominance, the implication of this term should be clarified. Dreikurs (*1*) has stated that the 'true mother subordinates her desires to the needs of the child.' The dominant parent represents the opposite of this—he subordinates the child to his desires, thus, depriving him of self-expression and self-development. Fitz-Simons (*2*) offers a list of specific dominating parental actions, which include: (1) Parent 'pushes' child, (2) parent threatens punishment, (3) parent 'nags' child, (4) parent spanks, whips child, (5) parent holds child to unsuitable standards, (6) parent criticizes child, and (7) parent threatens to evict child. Symonds (*10*) closely allies parental domination with over-supervision and over-protection: (1) insistence upon blind obedience, (2) close supervision of the activities of the child, (3) superimposed ideals, (4) too much supervision, (5) protection from harm, and (6) overanxiousness about trifles.

Where domination by the parent takes the form of outward manifestations of hostility and severity, the child may develop feelings of guilt, fear, and unhappiness. Such dominated children may also become aggressive, rebellious and quarrelsome. Where parental domination takes the form of over-supervision, the child subjected to this form may become less adequate, shy, bewildered, and confused. Whatever form of parental domination is used, the child's possibility of developing into a well-adjusted personality is seriously thwarted.

Procedure

In re-evaluating the data in terms of parental domination, a list of dominating characteristics, as suggested by several authorities in the fields of psychology and psychiatry was employed. This list may be outlined as follows:

1. *Domination as revealed by disciplinary action.* Parent insists upon blind obedience; parent threatens to punish or evict the child; parent 'nags' the child; parent spanks or whips the child.

2. *Domination as revealed by holding the child to excessively high standards.*

3. *Domination as revealed by over-supervision and over-protection of the child.*

4. *Domination as revealed by undue parental criticism.*

The investigator then collected all items from the original study which could be re-classified under the above categories, and an attempt was made to analyze each group of questions in terms of parental domination. Inasmuch as the original study was not designed primarily to reveal parental domination, complete and detailed coverage was much more complete in some categories than in others. All data gathered and evaluated was obtained from the mothers in personal interviews, and represents a report of specific parental actions in relation to the child, as well as parental attitudes, opinions, and observations. When the

TABLE 1. Comparison of responses of mothers of stutterers and of non-stutterers on items concerning domination by disciplinary action. (Number of pairs, 48)

Rank	*Item*	*Number of 'Yes' Responses*		
		Non-Stut.	*Stut.*	*Chi-Square**
1.	When your child misbehaved, did you threaten him?	13	33	16.67†
2.	Is it necessary to discipline your child very often?	6	27	14.23†
3.	Do you insist upon an immediate response to your wishes to do things?	15	32	10.70†
4.	When he refused to go to bed, did you threaten him?	5	19	9.80†
5.	For emotional behavior, do you spank him?	2	13	9.09†
6.	When he refused to go to bed, did you scold him?	16	32	8.00†
7.	When your child misbehaved, did you spank him?	37	47	6.75†
8.	Do you constantly remind him to sit up straight?	15	27	6.55‡
9.	Do you constantly remind him to put away his toys?	21	33	5.54‡
10.	Do you constantly remind him to keep his feet off the furniture?	16	26	4.55‡
11.	When your child refused to go to bed, did you spank him?	6	16	4.50‡
12.	When your child misbehaved, did you withdraw your affection?	0	6	4.17‡
13.	When your give your child food that he rejects, do you try to have him eat it?	22	31	3.24
14.	When this occurred (shocking sex behavior), did you scold him?	3	8	1.45
15.	When your child misbehaved, did you isolate him?	27	23	.62
16.	Do you give him the rejected food at the next meal?	3	4	.00
17.	When your child misbehaved, did you scold him?	45	45	.00
18.	Have you ever sent your child to bed as a form of discipline?	15	14	.00
19.	Have you ever punished your child to control bed-wetting?	1	2	.00
20.	When this occurred (shocking sex behavior), did you spank him?	1	1	.00

*Chi-squares in this and subsequent tables were computed by a technique for correlated samples developed by McNemar (7, 8).

†Statistically significant at the 1 per cent level of confidence.

‡Statistically significant at the 5 per cent level of confidence.

questions involved both parents, the mothers were asked to include the actions of the father as well in determining their answers.

Results and Discussion

According to authorities, parental domination may be revealed by the kind of disciplinary action employed by the parent. From the data obtained, all questions regarding disciplinary action reflecting domination (blind obedience, threatening, spanking, and nagging) were tabulated and are presented in Table 1. This table reveals that seven of the 20 items concerning discipline yielded differences that are significant at the 1 per cent level of confidence, while five are significant at the 5 per cent level.

Fitz-Simons (2) indicates that domination may be revealed by the parental action of spanking or whipping the child. When asked whether or not they employed this form of punishment, significantly more mothers of stutterers than those of non-stutterers replied 'yes.' One psychiatrist (*1*) warns that this form of punishment arouses fear and hate and is useless, absurd, and harmful; Symonds (*11*) found physical punishment to be a cause of children developing feelings of rejection. The large number of affirmative responses given by both groups, however, indicates that this was a popular corrective technique in general. Specifically, it may be observed that significantly more mothers of stuttering children spanked their child in order to get him to go to bed ($P < .05$) and for displaying emotional behavior ($P < .01$), both of which are extremely questionable procedures, and both of which may result in harmful repercussions in the psychological life of the child.

'Blind obedience' was felt to be reflected through an affirmative response to the question: 'Do you insist upon an immediate response to your wishes to do things?' Thirty-two mothers of stutterers while only 15 mothers of non-stutterers answered 'yes' to this question, which seems to indicate that the mothers of stutterers (as a group) were more dominating in this regard than were those of the non-stutterers. More information pertaining to specific acts in given situations is needed, however, to draw definite conclusions on this phase of parental domination.

Parental domination through disciplinary action may also be revealed by threatening to punish or evict the child. Information obtained on this phase of discipline reveals that significantly more mothers of stutterers than those of non-stutterers both generally and specifically admitted that they had employed this method of child control. According to Symonds (*11*), threats may be f o o l i s h and harmful—foolish if they are not carried out, and harmful if they have any traumatic effect on the child. Threats, if they are reinforced by frequent restatement, may arouse attitudes of hate and rebellion to authority instead of helping children to judge the merits of the situation.

A number of questions were asked which were felt to reflect nagging on the part of the parent. While no difference in group response is discernible on the question pertaining to the use of scolding in general as a disciplinary technique, differences are apparent on the two questions asked regarding scolding in connection with specific acts, namely, scolding the child for refusing to go to bed and while having speech difficulties (*cf.* items 6 and 7, Table 1). In both cases,

significantly more mothers of stutterers than those of non-stutterers answered 'yes' ($P < .01$). Constantly reminding a child to keep his feet off the furniture, to sit up straight, and to put away his toys suggest nagging and parental criticism. On all of these items, significantly more mothers of stutterers than mothers of non-stutterers reported that they had employed these negative practices. Further evidence of nagging may be indicated in the item regarding the necessity to discipline the child 'often,' in which case more mothers of stutterers than those of non-stutterers replied in the affirmative ($P < .01$). Too much discipline suggests nagging, fault-finding, and over-supervision, and fosters disobedience and hostility in the child and reflects domination on the part of the parent.

A difference found on any one item in any one phase of discipline does not in itself establish greater domination being present in one group than in the other; it is only when the evidence begins to accumulate on all aspects of discipline that a pattern or group tendency may be established. A review of the findings on this section reveals that in every phase of discipline considered in this study (spanking, threatening, nagging, and blind obedience), significantly more mothers of stutterers than mothers of non-stutterers gave answers which indicated parental domination.

Symonds and Fitz-Simons list 'pushing' the child and holding him to standards beyond his reach as being characteristic of the dominant parent. Information obtained on this phase of the study is tabulated in Table 2.

TABLE 2. Comparison of responses of mothers of stutterers and of non-stutterers on items concerning domination as revealed by holding the child to excessively high standards. (Number of pairs, 48)

Rank	*Item*	*Number of 'Yes' Responses* Non-Stut.	Stut.	*Chi-Square*
1.	Have you ever felt that your child has had to struggle to keep up to the high standards set by older siblings, or his parents?	4	29	21.55*
2.	Do you feel that your child is as well-behaved and as advanced socially for his years as he should be?	46	31	10.32*
3.	Did you attempt to perfect toilet training in a relatively short period of time?	3	13	5.79†
4.	Did you attempt to teach your child to read and write before he went to school?	2	9	3.27
5.	Has the necessity of good grades been stressed?	4	10	2.50
6.	Did you begin toilet training before he walked?	25	18	2.33

*Statistically significant at the 1 per cent level of confidence.
†Statistically significant at the 5 per cent level of confidence.

Many authorities believe that to push a child beyond his capacity puts him under a constant strain and creates nervousness. Statistically, two of the most significant differences in the entire study were on the questions dealing with reported nervousness and too-high standards, in which cases significantly more mothers of stutterers than those of non-stutterers reported that (1) their child was 'very nervous,' and (2) they felt that their child had had to struggle hard to keep up to the high standards set by his parents and others. These findings seem to corroborate the belief held by psychologists that too-high standards generally create nervousness. This does not imply that nervousness reported for the children in the stuttering group results entirely from too-high standards, as it is recognized that children who cannot communicate adequately are apt to suffer nervousness as a result of their speech defect and for other reasons as well.

It was also apparent that more mothers of stutterers than of non-stutterers indicated dissatisfaction with their child's immature conduct, which, although an attitude, might possibly indicate too-intense urging of the child by the parents to attainments beyond his reach by legitimate means, thereby contributing to the problem behavior with which they showed displeasure. Excessively high standards were also revealed in regard to speech, as more mothers of the stutterers than of the non-stutterers negatively evaluated their child's speech and employed corrective techniques in handling the situation. Further indication of too high standards being imposed upon the child may be seen in the item regarding an attempt to perfect their child's toilet training 'in a relatively short period of time,' in which case significantly more mothers of stutterers than of non-stutterers answered affirmatively to an item asking whether or not they had done so.

One phase of parental domination which revealed many disparities in response was that of over-supervision and over-protection of the child, in which area, 11 of the 27 questions asked significantly differentiated the two groups. As may be seen in Table 3, nine of these items are significant at the 1 per cent level of confidence, and two are significant at the 5 per cent level.

According to Dreikurs (*1*), frequent correction of a child suggests parental over-supervision, which, he states, discourages most children, impedes their conduct and achievement, and promotes disobedience and failure. On the questions pertaining to the correction of the child by his parents when he was having difficulty with his speech, significantly more mothers of stutterers than of non-stutterers replied 'yes' to questions asking whether or not they had 'supplied the word,' told him to 'stop and start over,' called his attention to his speech, scolded him for poor speech, and told him to 'think before he talked.' It is believed that these negative procedures of correcting a child's speech are instrumental in giving rise to anxiety reactions, ultimately leading to the development of the secondary symptoms of stuttering. In analyzing the responses to these items, one might well ask the question as to why the parents of the stuttering children became over-anxious and demanding concerning their child's speech while the parents of the non-stuttering children did not? One explanation may be that the speech patterns of the stutter-

TABLE 3. Comparison of responses of mothers of stutterers and of non-stutterers on items concerning domination as revealed by over-protection and over-supervision. (Number of pairs, 48)

Rank	*Item*	*Number of 'Yes' Responses* Non-Stut.	Stut.	*Chi-Square*
1.	Did you call it to his attention (when he was having difficulty with his speech)?	5	28	21.16*
2.	Did you tell him to 'stop and start over?'	15	40	18.94*
3.	Have you made this a definite routine with him (responsibilities around the house)?	34	14	16.67*
4.	When your child was having difficulty with his speech, did you supply the word?	13	31	12.46*
5.	When he was having difficulty with his speech, did you scold him?	1	13	8.64*
6.	When it is time to go to bed, do you allow him to finish what he is doing?	48	38	8.10*
7.	Has the child responsibilities around the house to perform?	41	28	7.59*
8.	Does he take care of his pet by himself?	20	8	7.20*
9.	When your child was having difficulty with his speech, did you tell him to 'think before he talked?'	18	31	6.76*
10.	Did you allow your child to feed himself as soon as he was able to hold a spoon?	44	33	5.88†
11.	Are his friends always welcome into his home?	47	40	4.00†
12.	Do you see that he eats slowly and does not hurry?	15	23	2.67
13.	Did you allow him to eat by himself even though he spilled things?	43	36	2.40
14.	Do you feel he needs more discipline than he receives?	4	11	2.40
15.	Does your child run errands across the street?	37	30	2.33
16.	Do you insist upon your child sleeping a fixed number of hours each day?	11	17	1.56
17.	Does you child ever take the bus alone?	13	7	1.56
18.	Does your child run errands within the block?	40	34	1.56
19.	Does your child have an allowance?	25	20	.91
20.	Did you try to help him with special speech sounds?	15	11	.64
21.	Did you try to 'ease the way' for him when he was having difficulty with his speech?	10	13	.26

*Statistically significant at the 1 per cent level of confidence.
†Statistically significant at the 5 per cent level of confidence.

Rank	Item	Number of 'Yes' Responses: Non-Stut.	Number of 'Yes' Responses: Stut.	Chi-Square
22.	Does he go to the movies with children his own age?	15	12	.21
23.	When your child awakes earlier than usual, do you allow him to get up?	31	33	.20
24.	Did the child perform nursery rhymes of his own free will?	41	39	.08
25.	Does he go to school by himself?	38	36	.07
26.	Does he go to movies by himself?	3	3	.00
27.	Do you give him the rejected food at the next meal?	3	4	.00

ing children were actually more hesitant and repetitious than were those of the non-stuttering children, which extreme non-fluency was corrected in the manner described above. On the other hand, if the Johnson hypothesis is valid (that what the layman diagnoses and reacts to as stuttering are the normal non-fluent speech patterns of young children), then both groups of parents were faced with some degree of non-fluency in their children. If both groups of parents were confronted with similar problems, the difference in response on the items discussed cannot be attributed to differences in the two groups of children, but, rather, to some inherent difference in the two groups of parents. Since frequent correction may be associated with over-supervision, and since over-supervision was also found to exist to a greater extent in the stuttering group than in the non-stuttering group of parents on other phases of the study, such as eating, sleeping, discipline, and the child's activities in general, one may be justified in concluding that incessant correction of a child's speech is but one manifestation of a larger pattern of parental domination.

Over-supervision was also indicated by the response to questions dealing with giving the child responsibilities. Significantly more mothers of non-stutterers than those of stutterers reported that they had allowed their child to (1) take care of his pet, (2) assume routine responsibilities around the house, (3) feed himself as soon as he was able to hold a spoon, and (4) invite his friends into his home. In failing to give a child definite responsibilities, the parent is neither contributing to the child's feelings of competence, nor treating him as a developing personality—both of which are basic needs of the child.

Further evidence of over-supervision is indicated by group responses to certain aspects of discipline discussed earlier. It will be recalled that significantly more mothers of stutterers than of non-stutterers (1) felt that it was necessary to discipline their child often, (2) did not allow their child to finish what he was doing before going to bed, and (3) 'constantly' nagged their child—all of which strongly suggests over-supervision.

While many items pertaining to over-supervision and over-protection do not reveal significant differences

between the two groups (*cf.* items 12 to 27, inclusive, Table 3), sufficient evidence is present to conclude that the parents of the stuttering children (as a group), according to their answers, appeared to over-supervise and over-protect their child to a greater extent than did the parents of the non-stuttering children, and, in this regard, were more dominant parents.

Several questions were asked which were felt to indicate whether or not the mothers had been unduly critical of their children—another aspect of the dominant parent. The data obtained on this section are presented in Table 4. Since much of the material discussed earlier suggests parental criticism and inevitably overlaps with this area, only brief mention will be made of these items.

Shaming or humiliating a child for any reason is stressed by authorities as most undesirable methods of parental control in that such practices may develop feelings of inadequacy and inferiority in the child, thus constituting a serious blow to his ego. Significantly more mothers of stuttering children than those of non-stuttering children reported that they had used shame and humiliation as forms of discipline ($P < .01$). An analysis of Table 4 reveals, however, that no significant differences are apparent on the questions pertaining to shaming the child for specific acts, which suggests that more research is needed in this area in order to establish the general difference specifically.

Greater parental censure also appeared to exist in other aspects of the

TABLE 4. Comparison of responses of mothers of stutterers and of non-stutterers on items concerning domination as revealed by parental criticism. (Number of pairs, 48)

Rank	*Item*	*Number of 'Yes' Responses*		*Chi-Square*
		Non-Stut.	*Stut.*	
1.	When your child misbehaved, did you shame or humiliate him?	4	18	10.56*
2.	When your child misbehaved, did you ever hold up a brother or sister, or another child as an example of good conduct?	6	17	5.76†
3.	When your child was naughty, did you ever use, 'I don't like you anymore,' as a means of making him behave?	0	4	2.25
4.	Do you ever shame your child when he bites his nails, picks his nose, or acts like a baby?	5	10	1.45
5.	Was it necessary to punish or shame him during toilet training?	4	7	.44
6.	If you were shocked by something your child said or did in connection with sex, did you shame him?	2	2	.00

*Statistically significant at the 1 per cent level of confidence.
†Statistically significant at the 5 per cent level of confidence.

study, some of which have already been discussed earlier. For example, significantly more mothers of stutterers than of non-stutterers (1) held up another child as being exemplary of good conduct, (2) criticized or corrected his speech, (3) did not feel that he was as well-behaved nor advanced socially for his years as he should be, (4) held him to unsuitable standards, and (5) nagged their child —all of which seems to indicate greater parental criticism or negative evaluation being present in the one group than in the other.

Since undue criticism is generally recognized by authorities as part of the domination pattern, and since significantly more mothers of stutterers than of non-stutterers gave answers to items indicating critical attitudes and procedures, it follows that these mothers in this regard were (as a group) more dominant parents.

Conclusions

The foregoing discussion has presented and analyzed information obtained regarding various aspects of parental domination. From this data it may be concluded that the parents of the stutterers were more dominant parents than were the parents of the non-stutterers.

1. Parental domination was indicated by the responses of more mothers of stutterers than by those of the mothers of non-stutterers on all phases of the study. Of the 59 questions asked in four aspects of parental domination, 19 (or 32 per cent) are significant at the 1 per cent level of confidence, and nine (or 15 per cent) are significant at the 5 per cent level of confidence; 47 per cent of all questions asked regarding parental domination are statistically significant.[1]

2. While the responses to many items are not significant, or only approach significance, a trend indicates more unfavorable answers by the mothers of the stuttering children on most of these questions. Of the 31 items which are statistically non-significant, 24 reveal more unfavorable answers by the mothers of the stuttering group.

The writer is inclined to agree with Glasner (*3*) that stuttering may not have its genesis in any one specific environmental factor, since case histories generally reveal several unfavorable factors to be operative, varying in kind and degree from case to case. On the other hand, the present study does not refute the Johnson hypothesis that stuttering is precipitated by specific acts in connection with the speech process; rather, the findings seem to substantiate this belief. The results do seem to indicate, however, that this may be part of a larger pattern of parental domination, which may account not only for the greater number of adverse environmental stimuli being present in the stutterer's environment, but for the injudicious practice of correcting and worrying to excess about the child's non-fluent speech patterns. In answering the question raised earlier as to whether or not there is a syndrome of environmental factors which seems to precipitate or aggravate stuttering with significant regularity, the writer feels that

[1]Many items related to a single factor (e.g., correction of speech in various ways) were, in part, responsible for this large percentage figure; related items may not be considered mutually exclusive significant findings.

that syndrome may be a variety of dominating parental actions, which, as are disclosed by the findings of this study, include: domination by disciplinary action, domination by over-supervising and over-protecting the child, domination by holding the child to excessively high standards, and domination by adverse parental criticism.

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Information Theory:*

1. Information Theory to 1951 — A Non-Technical Review†

Warren Weaver

IF THERE IS anything more formidable than to attempt, in less than half an hour, to give some information about information theory and to communicate about communication theory, it is to give a speech before a group of professors of speech.

How can there possibly be a quantitative, analytical, mathematical theory of information? This sounds appallingly like attempting to give a theory of the structure and content of all knowledge. And more specifically, *information* does not seem to have the sort of properties with which one deals in mathematical-physical theories. Decent quantities, such as mass and energy, for example, are conserved, as the physicist says—that is, the sum total remains constant. But just look at information! I possess an item of information, and I tell it to you. You now have it. But have I lost it?

Obviously not! In fact if I have done a good job in telling you about it, then all of us, as teachers, know that after passing the information on to you I not only still have it, but I very likely now possess it in an improved form, I having gained rather than lost by the process of expounding the subject to you.

Thus information seems to be more of a biological, rather than a physical, entity—a biological entity that has a sort of generating power to reproduce itself. How can there possibly be a physical theory for such a thing?

*The three distinguished papers here published as a group were originally presented at the 1951 Annual Convention of ASHA, Chicago, Ill., in a joint meeting with SAA under the chairmanship of James F. Curtis. In reproducing them substantially in their original oral form, the *Journal* deviates from its usual policy.

†The writer was asked to make a talk on information theory to an audience interested in speech problems. Assuming that most persons in the audience were unacquainted with the theory, and that they would not relish mathematical details, it seemed desirable not to be too severe as regards technical accuracy, to abandon any pretense of an orderly development of the subject, and to present a few main features which would indicate the general nature of the theory. This in turn, led to an informal mode of oral presentation, which was made without any manuscript.

Having been asked to write out what I said, I either have to stick to the same informal style, or I must substantially alter both the contents and the presentation. I have done the former, even though this sort of exposition is not very usual in print. As nearly as I can remember, this is what I said—although it is true that I have experienced esprit d'escalier, and at a few points this is not exactly what I said, but what I now wish that I had said.

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The answer to this question lies in the fact that the theory does not deal directly with the information itself, but rather with *representations*—physical representations—of the information. The small boy in school says 'Teacher, I know the answer to your question, but I can't say it.' Information theory has no patience with this little boy, for it has no concern with knowledge until it is expressed, written down, or represented in some definite way.

It is worth noting that this capacity to represent information is almost a defining characteristic of man as contrasted with the other animals. The symbolic representation of ideas clearly represents one of the greatest and most basic inventions man has ever made.

How can information be represented? Why with written words, ideographs, numbers, dots and dashes, electric current in wires, electromagnetic field vectors in space, with smoke signals if we are Indians or with drum beats if we are savages, with those pressure waves in the air which constitute spoken words, with pictures, with nerve impulses, and with many other means.

It is rather startling when first thought of, but if you were to examine carefully any of these methods of representing information you would find that they are all *discrete* in character—that they all make use of certain minimum indivisible descriptive units. In written speech, for example, the letters of the alphabet may be thought of as these units—you add to a written representation a single letter at a time, and it is meaningless to add a part of a letter.

Although not so obvious in the other cases, all representations share this property of being built up of discrete units. Thus one can think of adding, to a representation of information, by a unit amount; and thus one can count the number of descriptive units which compose a given representation.

But the moment we hear of units and of counting, then we are not surprised to find the mathematicians around, busy with working out relations between the magnitudes being counted.

When one gets down to the basic level of these indivisible units of a description, then it is clear that there isn't much to say beyond such elementary remarks as, 'A unit of description has been added,' or, 'A unit of description has not been added.' Or in still simpler terms, and in answer to the universally implied question as to whether or not a unit has been added, one needs to say simply either 'Yes,' or 'No.'

When we have one of these 'yes or no' situations (one of these 'all or none' situations so familiar to you in psychology and in neurology), the mathematician at once remarks that he is going to use a *binary* number system. Instead of using our familiar decimal system with its 10 digits, he will use a system which employs only the two digits zero and one.[1] Zero can mean no, and one can mean yes. This is a very appropriate and simple number system, and it happens to be the one used by most great electronic computers.

[1] Just as 3851, as written in the decimal system, means (interpreting the digits from right to left) 1 unit plus 5 tens, plus 8 ten-squares plus 3 ten-cubes, so 1011 in the binary system means 1 unit, plus 1 two, plus 0 two-squares, plus 1 two-cubes. Thus 1011 is equivalent to the decimal number 1 + 2 + 0 + 8, or 11.

This business of minimum elements in the representation of information may remind some of you of the work done about 30 years ago by a somewhat difficult but most imaginative and original logician named Wittgenstein. He reasoned that all statements could be decomposed into what he called 'atomic sentences.' These atomic sentences are all so completely simple in nature that one cannot usefully discuss their contents, but can only assert their existence or non-existence. These atomic sentences would be just what the logician would want to use as the minimum units in the representation of ideas.

If this binary, yes-or-no, basis for information seems a little queer and abstract to you, think for just a moment about the game of 'Twenty Questions.' Here the questioner starts out with a large store of unknown items of information. The contestants ask a question, and get for their answer simply 'Yes' or 'No.'[2] By asking a succession of such questions, they close down, step by step, onto the item of information they are after. With a set of atomic questions such as 'Is it a living man,' 'Is it a structure,' 'Can it be located geographically,' 'Is it east of the Mississippi,' etc., the item of information is represented or described by a sequence of binary digits as 0, 1, 1, 0, 0, 0, 1 . . . etc., meaning no to the first question, yes to the second and third, no to the fourth, fifth, and sixth, yes to the seventh, etc. The information is thus represented by a sequence of binary digits.

Now you must realize that you are hearing about a very new subject, so that there are a vast number of unsettled questions. Different workers have been developing rather different approaches, and for a time it rather looked as though these different theories were contradictory contestants. It is the present, and still tentative, view that this is not the case.

It is a little—as Donald M. MacKay has so usefully pointed out—as though three men were, at some rather primitive stage of science, arguing about a theory of *size*. The first man says, 'I have a most useful concept of size—I measure the *lengths* of objects.' The second says, 'Oh no! Size means *area*. I have a new and important theory about areas.' And the third says, 'Not at all! Size means *volume*. I measure volumes, and can relate this to weight, etc., in a most important and interesting way.'

Well, of course we now recognize that length, area, and volume are simply three different aspects of size; and that all three men were at once largely right and partly wrong.

In a way that is just a little analogous, we now think of there being three different aspects of information, each useful in an appropriate context. These three different aspects can be indicated by illustrative situations (and again I borrow from MacKay).

A friend tells you something; but you remark afterward, 'I didn't get much information, because what he said was almost exactly what I was sure he would say.' This remark emphasizes, and with shrewd accuracy, that from one point of view a remark has high informative content if it is *unexpected*. The more unexpectedness, the more information. This is the kind of information (or the aspect of information) which in present theory is referred to as *selective information*. In just a little we will see why

[2] This isn't quite right, but just forget about 'partly' as an answer.

the word 'selective' is used, but for the moment we need only remember that selective information measures unexpectedness. A unit of selective information is called a *bit*. This does not mean a *small piece*, for bit is really the first two letters and the last letter of the words binary digit.

Secondly, suppose we are interested in the heights of a group of say 1,000 men. At our request, a friend measures all these men and reports back that 31 are less than five feet tall, 843 between five feet and six feet, 125 are between six feet and seven feet, and 1 over seven feet tall. This friend has furnished us with the four numbers necessary to describe the heights of these men when classified into groups with a one-foot height differential. But we might say to him, 'We want more information than this. Go back and find out for us not the four numbers but rather the 30 or 40 numbers necessary to classify these 1,000 men into height groups which differ only by one inch. That is, how many of these men are between five feet and five feet one inch, between five feet one inch and five feet two inches, and so on.' This second description of the heights of these 1,000 men would indeed contain more information. And this is what present theory (here D. Gabor is largely responsible) calls *structural information*. Here what one is primarily concerned with is the *degree of complexity of form of the representation*. A unit of structural information is called a *logon*. We are not going to have time to talk about logons, and I include the word just because I once heard a minister say that it adds to the intellectual tone of a sermon to have at least one word in it which is unfamiliar to the audience.

Thirdly, suppose we are interested in the height of one particular man, and suppose two friends measure that height for us, the first with an accuracy of 1% and the second with an accuracy of 10%. We would all agree that the first friend has given us more information about the man's height. This is what is known as metrical information, and its unit is called a metron. Metrical information is measured by the *degree of confidence* which a descriptive statement merits.

So we see that modern theory deals with three different aspects of information—selective information which depends upon unexpectedness, structural information which depends on the complexity of form of the description, and metrical information which depends on the reliability of the description. The second and third aspects are of great interest to all those who are concerned with quantitative experimentation, and they are the fundamental concepts of what may be called *scientific information* theory. The first—selective information—is the basic concept of *communication theory*. And since we will from here on be talking only about communication theory, we will be dealing only with selective information.

Before one can usefully talk about communication theory, it is necessary to recognize the essential features of a communication system. Suppose (see Figure 1) we describe the situation in terms of the sending of a birthday greeting by wire. The original sender selects a message out of the *message source* (for example, a book of standard birthday telegrams). This is then *coded* (by the clerk who notes that this is, say, B-47, meaning birthday message number 47) and then further *coded* by the *transmitter* (the stand-

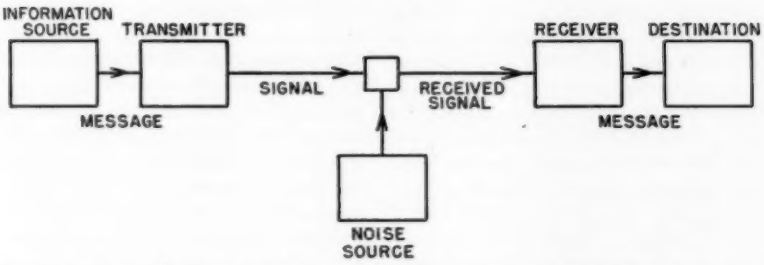

FIGURE 1. Schematic diagram of a general communication system. From Shannon, C. E. and Weaver, W. (*4*).

ard telegraphic sending devices) into the *signal* (electrical dots and dashes) which pass over the *communication channel* (the telegraph wires), to reach the *receiver* where it is *decoded* into B-47 and eventually into the words of the birthday *message* which then passes to the *destination*. And we must note that *noise* (a general term for undesired additions to the signal) may have entered (a severe electrical storm, for example) so that the *received signal* differs from the originally *transmitted signal*.

You can readily describe for yourselves the same essential steps for a telephone communication system, or for television, heliograph or wig-wag signals from ship to ship, for drum beats in the jungle, or for smoke signals. For the last case, the 'noise' might be fog which interferes with seeing the signals, or gusty breezes which might obscure their separate identity.

Since we are primarily interested in communication through spoken speech, perhaps it would be well to remind ourselves of the steps here, using language that indicates that there are several internal communication systems involved, as well as the more obvious external one.

Through some as yet quite unknown mind-brain process a message is selected. It is coded by the brain into a spatial and temporal pattern of nerve impulses (each unit of which, incidentally, is one of these atomic, yes-or-no, exist-or-not-exist, 0 or 1 affairs). These nerve impulses pass to the hind brain and spinal cord, and then over peripheral nerves to the muscles of the larynx, pharynx, mouth, chest wall, and diaphragm. Here the signal is recoded into the sound (pressure) waves in the air, which are received and decoded by the organ of Corti of the ear into a new pattern of nerve impulses. These pass over the VIIIth nerve into the medulla and ultimately to the acoustic area on the temporal lobe of the cortex; where again, and again by an unknown brain-mind process, the signal is decoded into the message of which the receiver is conscious. At almost any stage of this process, 'noise' may impinge, to distort, to weaken, and otherwise to deteriorate the intended message.

For communication systems of this sort, there has been worked out, chiefly over the last few years, an amazingly interesting and valuable theory. We can't hope to do more than get some glimpses—I hope tantalizing glimpses—of what this theory is. We must content ourselves with looking

at one or two important concepts of the theory, and one or two of the main results.

Suppose we spend a little time examining some of the ideas developed in the theory concerning the *message source*. It is not too incorrect to think of the message source as a huge filing cabinet which contains very many, but still a finite number of messages. This filing cabinet is constructed so that it is in general easier to get at certain messages than others. Thus if you are about to select a message out of this filing cabinet, it is more likely that you will select certain messages, and less likely that you select others. In fact, each individual message has associated with it a probability—the probability that it will be next selected.

When one is confronted with this sort of situation, where the events that occur are not determined by some completely predictive theory, but where the events are subject to probability laws, then one says that this is a *stochastic process*.

And suppose further that the filing cabinet is so constructed that the ease of getting at the various messages is, at any juncture, influenced by the next preceding choice and perhaps by several preceding choices, just as though these preceding choices had involved leaving certain drawers of the cabinet partly open, and therefore more than commonly accessible. Then the probability for selection of the various messages is dependent on what the past selection of messages has been. In this sort of a situation, the theoreticist says that he not only has a stochastic process, he has a *Markoff* process. Markoff processes are named after, if you will pardon the expression, a great Russian mathematician of that name.

Now you may consider it strange or even absurd to talk about the *probability* of selecting a message from the source. You say, 'Why I certainly am capable of definitely deciding, as a matter of free will, what message I will choose.' Part of the answer to you lies in the fact that a communication system is designed not just for you, but for the whole vast group of customers who select messages. *You* may feel quite free to select Birthday Message 47 rather than any of the others; but it will still be true that the various messages are, on the whole, each selected a characteristic fraction of the time, so that there is still a well-defined probability, with respect to each message, that the next unknown customer will select it.

And part of the answer lies in the fact that you are really mistaken when you think that you are completely free in your choice. Suppose, as an illustration, that we are dealing with a message source which has *words* filed away in it, rather than whole messages; and suppose we produce a message by successively choosing one word after another. Suppose that you have, up to this moment, chosen the words, 'I wish to,' and you are now ready to choose the next word. Are you really free in that next choice?

Of course you are not. The probabilities are exceedingly low, if not indeed zero, that the next choice could be *elephant*, or *rancid*. The next word just could be *nevertheless* (if you don't mind splitting infinitives); but it is much more likely to be a verb form such as *state* or *go* or *run*. You are clearly dealing here with the Markoff variety of a stochastic process.

Now a communication system should be designed to cope as well as possible with the probable demands on it. Otherwise stated, it should be designed with a view to the statistical characteristics of the message source which it must serve. It should do a good job for the good (i.e., the frequent) customers, and it can afford to do a poor job for the very infrequent person who makes a queer demand. The mathematical theory makes entirely precise and quantitative this qualitatively rather obvious fact.

The stochastic nature of written communication has, of course, been long recognized. When the telegraphic code was first designed, why did Morse assign the simplest symbol of one dot to the letter E, and the most complex symbol of three dots, a space, and a dash, to the letter Z? For the very good statistical reason that he counted the supply of type in a printing office, and found that they had a maximum number (12,000, in fact) of examples of E, and the minimum number (only 200) of Z.

Now when a message is selected out of a source, just what is the *information* involved in this process? In the mathematical theory the word information does not at all refer to the *meaning* of the particular message selected. Indeed it refers hardly at all to the particular message selected, but rather to the potentialities of message selection from this particular source. How many messages does this source offer, and how probable or improbable of selection are they—and accordingly, how *unexpected* is a message thus selected from this source. We now see why this kind of information is called *selective* information.

Again we can get an idea—at least a rough idea—by thinking of the game of Twenty Questions. The *information* associated with a message source is pretty well measured by the number of questions you have to ask in order to close down on a particular message. Each question (a binary choice) divides the filing cabinet into two parts, one of which may be forgotten since the message is known to lie in the other part. The two parts need not be equal in size. When one asks, 'Is it a living American man?' the yes part of the filing cabinet is clearly smaller than the no part, since the 'animals' which are not living American men greatly outnumber those which are. This corresponds roughly to the different probabilities of selection of messages in an information source. Whether you get this rather finer point or not is unimportant. It is, however, important that you get the basic idea that the more binary choices—the longer you have to play Twenty Questions, the more unexpected is the item finally revealed, and the more informational is the process.

Just as the information source has statistical characteristics (which are precisely defined and measured in the theory) so the communication channel has also. And as an illustration of the kind of theorems produced in the theory, consider the transmission of discrete signals over an ideal system which is free from noise. The theory reveals that there is a certain maximum rate at which symbols can be transmitted. This maximum rate can be simply and exactly expressed in terms of the statistical characteristics of the information source and of the communication channel. In general

this maximum rate will not be realized; and to obtain it, one has to use exactly the right method of coding the message into the signal. The theory reveals just what this most efficient coding is, although there is still a lot of work to be done on the practical problem of obtaining this most efficient coding in actual situations.

In the more realistic case where noise is present, and where continuous voice waves, for example, are being transmitted with a certain average signal power P over a certain band-width W, the noise having average power N, then a theorem which is one of the great triumphs of the theory states that with the most efficient coding one can transmit at the rate of

$$W \log_2 \frac{P+N}{N}$$

bits of information per second with negigible error, but that whenever you try to force a higher rate of transmission than this, you are bound to pay the price of more and more error in the messages received. I hope very much that you get, even though necessarily somewhat roughly, a sense of the remarkable simplicity, precision, and inclusiveness of this theorem.

As one more important concept of the theory, let's look for a moment at the idea of *redundancy*. When I select out of a message source I have a certain freedom of selection. I would have a larger freedom of selection if there were no probability hang-over from the past—if at each selection I were entirely free to disregard the past. Divide the actual freedom of action (which is numerically expressed in the theory) by the larger, maximum freedom of action I would have if uninfluenced by past selections. Suppose that this division produces the ratio 8/10. That means that I am 8/10ths as free to choose as I would be if uninfluenced by the past selections. This in turn means that 2/10ths of my maximum possible freedom of selection is removed because of the statistical linkages which exist between the messages, or words, or symbols in the source.

This 2/10 of lost freedom is called *redundancy*. When I talk—as I am now doing—I have the idea that I am free to choose my words, one at a time. But of course this idea is really an illusion. Unless I talk complete and jumbled nonsense—which I hope you do not think is the case—I have to form my sentences within the normal statistical framework of English speech. It turns out that English is actually just about 50% redundant. About half of the choice is really up to me, and the other half just automatically results from our common basis of agreement as to the way English is put together.

This idea of redundancy is, of course, not new—what is new is that we now have a precise definition for it, a precise way of measuring it, and a theory that shows just how redundancy operates. Redundancy has the advantage of protecting against error, but it has the disadvantage of cluttering up the communication system with material which is really not essential to the transmission of the information. By reducing redundancy, for example, one can have the same rate of information transmission with a narrower band-width, a fact of great importance to radio and television engineers.

The decoding of the Rosetta Stone was complicated because of the re-

dundancy present, since often several different symbols were used for the same syllable, to gain semantic precision. Classical Hebrew takes advantage of redundancy by printing (except in books for the young) no vowels. Shorthand is possible because of redundancy, and so are crossword puzzles.

I have described redundancy because it is involved in a matter which I am sure is of interest to the members of this audience. How much redundancy is there in speech sounds? How successfully can information be transmitted through the use of highly simplified speech sounds?

A great deal is known, of course, about this from an experimental point of view. We know that by using only larynx pitch—the so-called voiced sound—and the hissing or breath tone, there can be produced an intelligible imitation of normal speech. How much can this be refined through the use of information theory? What might this mean in connection with the problem of teaching a person with an imperfect voice apparatus to make sounds which succeed in communicating? It is quite clear that a normal person is substantially over-equipped with voice apparatus. How can one most efficiently, from the essential point of view of conveying information, utilize a less than complete apparatus? I surely know none of the answers, but I do think that these questions indicate that modern information theory has something to offer to those concerned with speech communication.

Indeed I can quote a high authority to substantiate this same general point. In an excellent review article on acoustics printed in this month's issue of *Physics Today*, Harvey Fletcher (2) says:

> Mathematical relations are now available for predicting how well one person, called the listener, will recognize the speech sounds of another person, called the speaker, in terms of the physical constants of the medium transmitting the sounds, and in terms of the practise coefficients of the speaker and listener. These equations are no doubt related to the information theory equations which have created so much excitement in the communication field during the last few years, but the connection has not yet been made.

I hope that some of you will make the connection.

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Information Theory:
2. Applications Of Information Theory To Research In Experimental Phonetics

Gordon E. Peterson

THE PROBLEM with which we are confronted in this discussion is more fundamental in character than may be suspected. The mathematical theory of communication is quantitative in character—it deals with measurement, codes and probabilities. Experimental phonetics deals with subjective effects in speech—the interpretation of speech involves human perception and judgment.

When we think of communication among individuals we think of the transmission of meaning, of such terms as semiosis, syntax, and semantics. Now the student of experimental phonetics cannot disregard those concepts; the student of phonetics who is not also a student of phonemics is doomed to despair in the pitfalls of his own dialect (*4*). But the student of experimental phonetics can and does study the human vocal mechanism as a machine, a tremendously complicated machine, in truth; one which obeys only in part the orders conceived for it. Of even more serious difficulty, however, is the fact that the very conception of the instructions to this device depend upon the operator's past experience in its use.

Our problem then is to consider wherein the tools of information theory may serve in the description and study of the operations of the human vocal mechanism.

In the beginning let us consider the general nature and purpose of the work which has been done in the field of experimental phonetics. While interest in these matters dates far into past centuries, the growth of quantitative information has followed the development of scientific methods and the appearance of measuring apparatus (*29*).

Studies in Experimental Phonetics

There are two general types of information which have been obtained.

The first we may call information about physiological phonetics; it deals with the physiology of the vocal mechanism and concerns such matters as the formation of vowels and breath stream dynamics. Many experiments on the movements and positions of the vocal organs were carried out by European students during the latter part of the previous century. This work is represented, for example, by the writings of Rousselot (*27*); in

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such studies the kymograph played a major role as the data recording device. More recently in this country Stetson (*31*) and others have reported studies of the speech musculature and air stream movements.

The X-ray and motion picture studies of the vocal mechanism have also contributed greatly to our knowledge of its operation. Notable among these are the X-ray tracings of vowel positions by Russell (*28*) and the high speed motion pictures of the vocal folds by Moore (*19*).

The second general type of information about the human vocal tract concerns the sound waves which it emits; this field of study may be called acoustic phonetics. The study deals primarily with the frequency and amplitude content of speech waves as a function of time.

This field of study has commanded the interests of many over a considerable period of time, and includes such names as Wheatstone (*32*), Helmholtz (*13*), and Miller (*17*). In this country, more recently, major contributions to this field have come from studies at the State University of Iowa with the Henrici harmonic analyzer (*1*) and from analyses employing filters at the Bell Telephone Laboratories (*26*).

Concurrent with these basic studies have been certain rather practical interests in experimental phonetics. Foremost among these have been those of the teacher. Though it is true that in the facts and figures of experimental phonetics, the teacher has often found a curious tone of irrelevance, yet particularly in the fields of speech and hearing therapy the teacher has found a real need for basic information, for an understanding of muscle movements, palatograms, and decibels. Further, the application of instrumentation to teaching—the use of tape recorders, VU meters, and sound spectrographs—is certainly increasing.

A second important interest of a somewhat practical nature has been the development of speaking machines. The tale of these devices forms a long and interesting story in itself. There is the early mechanical device of von Kempelen (7), completed in 1791; there are the acoustical models of Paget (*22*), and the organ pipes of Miller (*17*). Later came the work of Homer Dudley at the Bell Telephone Laboratories who produced the voder (*6*). The voder consists of an arrangement of electronic circuits which the operator controls by means of keys. The vowels and consonants are produced in sequence over a loudspeaker to form intelligible speech. It was Dudley, also, who developed the vocoder in which, as the name implies, a coding process is employed (*5*). In this device the speaker's voice is analyzed and transformed to a series of control currents. These currents may then be transmitted over a channel whose capacity is much less than that required to transmit the speech directly. The received currents in turn control the noise and tone output of a series of channels which are combined to reproduce the original speech over a loudspeaker.

More recently the work of Dunn (*8*), which culminated in the development of an artificial vocal tract, has offered certain unifying principles in the fields of physiological and acoustic phonetics. On the basis of a simplified model of the vocal tract, he has developed equations which make it possible to compute approximately the spectrum of a vowel from a knowledge of the vocal tract con-

figuration. The validity of these calculations is supported by the quality of the vowels produced by the electrical analog to the human mechanism which Dunn and Schott developed based on the equations.

New Objectives in Experimental Phonetics

In recent years there has arisen a new purpose to the work in experimental phonetics which promises at once to be of tremendous practical importance and to stimulate research which will afford a much deeper insight into the processes of speech. An appreciation of this latter objective has developed along with the growth of interest in control systems, servomechanisms, and computers. In simple terms, we are to set up machinery which will carry out spoken orders automatically. This objective of which we speak is essentially that of extracting the phonetic content from speech by automatic means. Hence we may consider as irrelevant other types of information carried by the voice: for example, that the speaker stutters, that he is in a hurry, that he has a cold, or that he is, say, Theophilus Ignatius.

Certainly there is no thought that

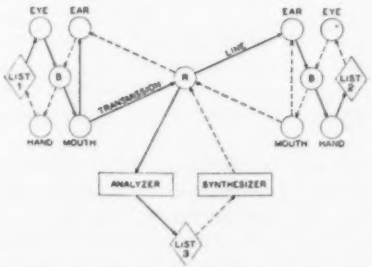

FIGURE 1. The communication situation involving speakers, listeners, and automatic equipment. (B, Brain; R, Recorder)

from the streams of speech which are produced either human or machine can regularly deduce all that the speaker intends to convey nor all the meanings associated with his act of speech. Much is lost at the mental association levels and never appears as speech; surely much should be lost, but that which achieves communicable form is often an inadequate representation of the parent ideas (*14*).

For all these inadequacies the words which do appear can represent things, relationships, and operations. It is these with which we are concerned.

From a linguistic point of view the basic process of speech recognition is represented in Figure 1. In the situation depicted here, a speaker reads from a list of symbols, shown as list 1. These symbols are recorded and are subsequently reproduced for a listener, who writes list 2. We may be sure that unless the speech is exceedingly distinct, the communication channel good, and unless the two subjects have very similar dialects the two lists will not entirely correspond. It is interesting to speculate on what changes the lists would undergo if the listener now repeated his list 2 back to the speaker who constructed a new list, etc. It will be noted that the feedback path from mouth to ear is not to be disregarded in such a diagram.

Now the general research objective of which we speak may be explained in terms of list 3, which is to be derived from the recorded signals by automatic means. As we choose, we may define the problem as that of making list 3 correspond most closely either to list 1 or list 2. It is interesting to note that a synthesizing device, as discussed earlier, may now be introduced to reconvert list 3 into recorded speech. In essence, we are adding an automaton, an imitation of a

living organism (but obviously very limited in function) to the communication situation.

It is recognized that the objective described above represents a rather new point of view in the control of machines, and much basic research is yet to be carried on. We are proposing, in essence, to take the highly variable and highly complex output directly from the human being, extract its symbolic value, and reduce it to systematic operations. Already there has appeared in the literature, however, adequate evidence that on certain repeated samples of speech, information which identifies the phonemes consistently can be extracted (*23*).

The Mathematical Concept of Information

Many times throughout the above discussion, the terms information and communication have appeared. The work of Hartley (*12*), Shannon (*30*), and others affords a quantitative measure of information and of the capacity of a communication channel, when these terms are used in the somewhat restricted sense defined by the theory.

For example, when a number of symbols, N, are equally likely to occur in a communication situation, the amount of information, H, contained in the appearance of any one of them is given by the following relationship:

$$H = \log_2 N$$

It is important to note that the amount of information conveyed by a symbol depends upon the number of different symbols which could have occurred. Can such a concept be useful in experimental phonetics? We must consider this question.

When one is first introduced to information theory, the use of the logarithm may appear unnecessary. Actually it is used primarily as a convenience both in definition and for carrying out operations. Many readers will be familiar with the concept of the decibel:

$$\text{db} = 10 \log_{10} p_1 / p_0$$

Here p_1 is a power level of interest and p_0 is the arbitrarily chosen reference power level. We know, for example, that under certain conditions it is convenient to add or subtract decibels.

The use of $\log_2$ here may be interpreted as meaning that information is defined in terms of the minimum number of choices necessary to select one symbol from a group of N possible symbols; that is:

$$N = 2^H$$

and

$$H = \log_2 2^H$$

The unit of information in which H is measured has been called the bit, which is a contraction of binary digit.

Next let us consider an elementary case in which all symbols are not equally likely to occur. It is here that the concept of probability enters the theory of information. The amount of information conveyed when the ith symbol occurs, with probability p_i is given by:

$$H_i = \log_2 \frac{1}{p_i}$$

And the amount of information per symbol averaged over all symbols is:

$$H = \Sigma p_i H_i$$

It will be noted that the concept of information defined above appears to bear little relationship to meaning, but is concerned abstractly with what may occur and with the probabilities of these occurrences.

In fact, two symbols which are equally likely to occur, and which carry equal amounts of information, as defined above, may differ radically in the amount of meaning conveyed.[1] For example, one symbol may tell a man that his house is on fire; a second symbol, which we may consider of equal probability for the purpose of illustration, may inform the gentleman of some utterly trivial matter.

The Fundamental Research Problems in the Automatic Control of Devices by Means of Speech

The steps which the author considers basic in the control of instruments by means of the voice are shown in Figure 2. At the top of the diagram is represented the original speech signal; at the bottom are represented the operations which the speech is to control. It is generally believed that the steps fall into a series of descending difficulty. That is, step (a) is the most difficult; it requires by far the most basic research. As we progress down the ladder we find that more and more knowledge of how to implement the next operation is already available.

Briefly, the steps outlined in Figure 2 are as follows: The original pressure wave at (a) is converted into fundamental psycho-physical parameters at (b). These are the parameters which bear the phonetic content of speech; most of these parameters vary relatively continuously over an interval of time. The parameters of (b) appear in quantized form at (c). The speech elements at (c) may be defined as phones. They are perceptual in nature and are specified here as the minimum distinguishable phonetic units (*25*). Phones are independent of meaning in language. At (d), however, the phones are assigned to phonemes which are linguistic elements. Phonemes are groups of phones; among various dialects and languages, the phones are grouped somewhat differently into phonemes. The phoneme is defined here in a manner similar to that employed by recent students of linguistic theory. These workers have been able to provide a practical and operational definition of the term in establishing methods for the reduction of a language to a consistent orthography.

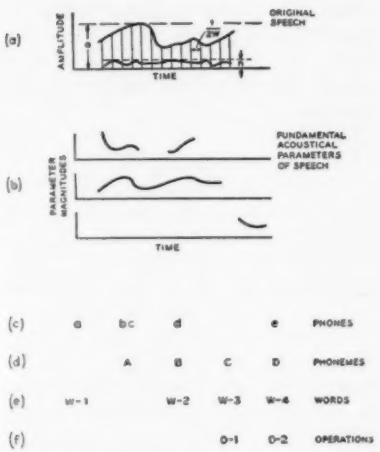

FIGURE 2. Schematic of the major steps in the development of equipment which can be controlled by speech.

At (e) the phonemes have been combined into words. This step may not be essential in all cases. The transformation to words is by no means simple, however, for it requires, among other things, the derivation of phonetic and phonemic rules which

[1] In this case the two symbols to which we refer may be two sentences.

determine word spacings within a given language. At (f) are represented the operations which were ordered in the original message. These are derived from the word combinations at (e).

A. At the beginning of Figure 2 is shown a continuous speech wave. This wave is shown in graphical form with amplitude a function of time. There is an upper frequency limit to this wave beyond which we are not interested, such as 7000 cps (*10*); the total bandwidth of interest we shall call W. This bandwith is a factor in determining the maximum rate at which information can appear in such a signal.

The other factor which determines the maximum information rate is noise. In such a signal there can always be found a certain amount of noise. This noise may emanate from many sources, among them are unwanted acoustical and electrical noise and errors in the recording equipment. If we assume an ideal case of known random noise, then this noise specifies the accuracy with which we can observe any given amplitude in the signal. In Figure 2(a) the irregular line near the bottom of the picture represents the amplitude of this noise. The amplitudes which we will measure will be amplitudes of the signal plus that of the noise, and they will be measured in minimum steps of n. The total number of steps possible is thus $\frac{a+n.}{n}$

It is fundamental to modern quantized modulation systems that a signal whose upper frequency limit is W cps can be completely specified by $2W$ amplitude samples per second of the signal, spaced $\frac{1}{2W}$ seconds apart (*21*). These amplitude samples are shown by the regularly spaced lines in (a).

We must recall that information is expressed in terms of the number of possible signals which may occur and in terms of the probabilities of these occurrences. For simplicity, if we assume that the noise is random and has a spectrum which is constant with frequency, that all forms of the signal may occur up to some maximum amplitude a, and that these signal forms are all equally probable, we can now state the maximum amount of information which could be present in the signal. The following expression shows the maximum rate with which information can appear in bits per second in such a signal.[2]

$$H/\text{second} = 2W \log_2 \frac{a+n}{n}$$

When the conditions are those specified above it can be shown that the following equation expresses the result in terms of power. Here S is the signal power and N is the noise power.

$$H/\text{second} = W \log_2 \frac{S+N}{N}$$

Let us assume a signal to noise ratio of 50 db. Then:

$$H/\text{second} = 7000 \log_2 (10^5 + 1)$$
$$= 116{,}267 \text{ bits/second}$$

The actual rate at which information is received, as explained below, is considerably less than this. Here we define received information in terms of the total communication situation, that is: Information source → Transmitter → Communication Channel → Receiver → Destination.

[2]The preceding discussion should be considered as explanation rather than as a development of the equation. For development of this equation see Part IV of reference 30.

In the type of signal depicted in Figure 2(a), there may be some question as to whether all possible amplitude values (below some specified maximum) can occur, but certainly the values which do occur do not appear with equal probability. In the second place, there are situations in which it may be difficult to specify the noise. Finally, there is no reason to believe that the human sensory apparatus can make the rapid and precise discrimination required to give it a channel capacity comparable with that estimated above for the human sending apparatus.

It should also be noted that an appreciable portion of the information present in the original signal is not of interest to a voice operated device. Incessantly throughout the signal there appears information that the speaker has a breathy voice, that he is nasal, or that he lisps; these facts are associated with the information that he is Theophilus Ignatius. Since these facts are broadcast by the speaker every time he speaks, we soon cease to derive any additional knowledge of this sort from his voice; this information is redundant.

B. If we look ahead for a moment the reader will probably recognize that the derivation of phonemes, shown at step (d), is fundamental in the operation of voice controlled devices. Now phonemic value is derived from phonetic value (*23*). As previously stated, the phone is here defined as the minimum discriminible phonetic unit. Phones are shown at (c) in Figure 2. As is generally known, the same phonetic values are often allocated to different phonemes in different languages.

In Figure 2(b) are shown the fundamental parameters from which the phones may be derived. A large number of dimensions are required to specify the complete speech spectrum as a function of time. Our knowledge of the manner in which speech is produced and of perceptual processes in general, however, would indicate that each detail within the spectrum is not evaluated independently. It is probable that from the individual elements within the spectrum certain more general parameters are derived. In this case a change in the value of an individual component, of course, could alter the value of a parameter. In the storage of information for recognition purposes, however, only values of

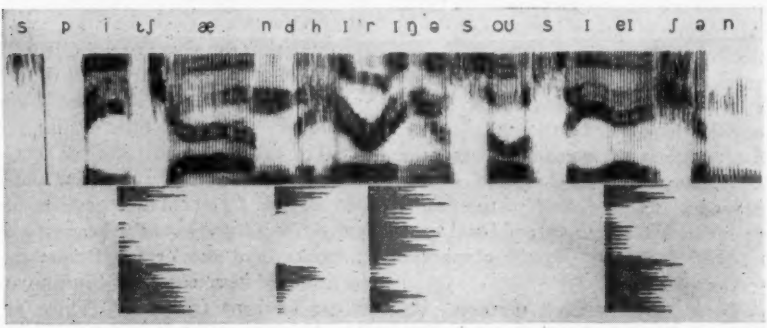

FIGURE 3. Broad band spectrogram and amplitude sections of 'Speech and Hearing Association.'

TABLE 1. Energy composition of various phonetic classes.

Energy Characteristic	*Plosives*		*Fricatives*		*Nasals*		*Vowels and Semi-Vowels*	
	Voiceless	*Voiced*	*Voiceless*	*Voiced*	*Whispered*	*Voiced*	*Whispered*	*Voiced*
Periodic		V		V		V		V
Random			V	V	V		V	
Gap	V							
Rapid change in level	V	V						

the basic parameter would be retained, so that the required storage capacity would be much less than if values for each variable within the spectrum had to be remembered. In essence, then, we propose to reduce the acoustic speech waves to a small number of fundamental parameters.

A suggestion of what may be involved in the second step can be obtained by reference to Figure 3. In this figure is shown a visible speech record and its corresponding phonetic transcription. In the upper portion of this figure time is shown along the horizontal dimension and frequency is shown along the vertical dimension; intensity is represented by blackness. In the lower portion of the picture are shown amplitude sections. Amplitude is shown horizontally on a decibel scale and frequency is shown vertically, with the lower frequencies at the top of the section. Zero frequency is marked artificially as the long spike at the top of each section; high frequency accentuation is employed in marking these pictures. The analyzing filter in the broad band spectrogram is 300 cps; in the amplitude sections it is 50 cps.

These visible speech pictures provide considerable detail about the frequency and amplitude content of the over-all speech wave as represented by Figure 2(a). Sound spectrograph techniques, in fact, provide us with powerful experimental tools with which to search for the fundamental parameters depicted in step (b).

It will be noted that two general types of energy are apparent in Figure 3, energy which is primarily periodic and energy which is primarily random. It is well known, and very well illustrated in the book *Visible Speech* (*26*), that certain energy compositions are associated with certain phonetic classes. These relationships are shown in Table 1.

The heavy black bands or bars which move throughout the upper pattern of Figure 3 are primarily associated with the positions and movements within the vocal cavities. It will be observed that these are to be found in both the vowel and the continuant consonant patterns. The amplitude detail of the bar is shown in the spectral representation of the lower portion of the figure. These regions of energy concentration have been called formants, and the center frequency (usually the formant peak) is known as the formant frequency. Thus far this definition of formant frequency has been applied to vowels chiefly.

There appear to be two general possibilities as to the basic nature of the parameters shown at (b). First, they may be fundamentally sensory in character; specifically, these parameters may represent relationships in the auditory patterns which are evoked by speech. Studies which involve a hypothesis of this type require a transformation of the original signal into presumed psycho-physical patterns (*24*).

Secondly, it is not impossible that the fundamental parameters represented by (b) are actually vocal tract configurations and operations, and that these are derived from the speech signal as it is heard. To illustrate, one possibility under this system would be that phonetically equivalent vowels by different speakers would have the same vocal tract shapes. If this were the case then, except for differences in vocal cord spectra, all phonetically equivalent sustained vowels should have similar spectral forms and it should be possible to equate their envelopes by a properly chosen normalization.

If the above hypothesis should be found correct, then effects of assimilation (*16*, *11*), etc., would be particularly important in the evaluation of continuous speech patterns. Speech involves a sequence of rather continuous mouth movements. The position of the mouth at any given instant depends in part upon the preceding position of the vocal organs and the intended position for the next sound. We are not only caught in a system of physiological constraints as we form speech but we are required to predict future positions of the mechanism.

It is possible, then, that the parameters shown at (b) may be basically auditory in character (*15*) or that they may be physiological in nature. Whatever research may eventually prove the situation to be, the parameters shown at (b) must be derived from experiments involving audition.

For the purpose of illustration, let us assume that these parameters are based upon auditory patterns. Then it follows that the scales in which these parameters are expressed should be psycho-physical in nature. In this case it is probably safe to expect that the signal at (a) could be converted into the significant psycho-acoustical parameters at (b) by relatively direct analyzing equipment.

As a simple example of the application of information theory, let us assume that the frequency of the second formant (F_2) is a fundamental information-bearing parameter in speech. Since the range which F_2 traverses varies for different speakers we must assume a particular voice (*23*). Let us assume that within a specified range all values of F_2 are equally likely to occur. The accuracy with which we can measure a formant frequency will depend upon the harmonic spacing, that is, upon the fundamental frequency, F_0. As a first approximation we may assume that the accuracy is directly proportional to F_0.

The maximum rate at which F_2 makes significant frequency changes is related to the syllabic rate of speech and is of the order of 15 or 20 cps. The bandwidth involved we may call W. The maximum number of steps is determined by the range traversed by F_2 and by kF_0. Thus under the above condition the maximum rate with which information can appear in bits per second in this parameter will be

given by the following relationship:

$$H/\text{sec.} = 2W \log_2 \frac{(F_2 \max - F_2 \min)}{kF_0}$$

As a practical case, let us choose a range of 2500 cps for F_2 and a fundamental frequency of 100 cps. In this example we shall consider $k = 1$.

$$H/\text{sec.} = 2 \times 20 \log_2 \frac{2500}{100}$$
$$= 40 \log_2 25$$
$$= 186 \text{ bits/sec.}$$

It should be noted, of course, that this illustration is for one parameter only, and that actually there are several parameters to be considered.

C. As we move along in Figure 2, it is clear that any general solution to the problem of phonetic control of device operations will not involve a direct step from (b) to (c). Such a method would be suitable only for a very limited vocabulary, for a set of parameter values must then be stored for every word to be recognized. This approach, for example, makes the instrumentation of a phonetic typewriter highly impractical.

The step from (b) to (c) in Figure 2 actually presents a problem of no small magnitude.

As previously indicated, the parameters at (b) are usually continuous over appreciable intervals of time, whereas the phones at (c) are time quantized. This is illustrated by the fact that in many monosyllables only one vowel is to be heard, a vowel which can be isolated by the phonetician and reproduced as a sustained vowel.

Of considerable importance is the question of how long a sample of time in (b) is required in order to determine a phone at (c). If the parameters are basically psycho-acoustical in nature there are at least two reasons why we should not expect a dependence of the phone upon values in (b) which extend forward or backward beyond one phoneme. First is the fact that certain of the parameters of (b) may at times be continuous only for an extent of one phoneme. Second are experiments in audition which would indicate that significant effects upon auditory perception will not extend beyond a few milliseconds in the typical speech signals. For example, the experiments of Miller and Licklider (*18*) on interrupted speech would support this conclusion. Similar conclusions are evident in the recent outstanding work on delayed masking (*20*). We may cite, also, the fact that the highest frequency passed in the vocoder control circuit channels is normally about 25 cps (*5*). The choice of this upper cut-off as optimum for the filters essentially means that, at least for the continuants, changes in spectral structure in less than 1/25 second are of little importance, but that for good speech quality we must be able to observe changes at rates approximately as fast as this.

If the parameters are basically physiological, however, then we might expect that the evaluation of a given phone would be based upon a somewhat longer sample of the speech signal. This would depend upon the nature of the inertia effects, assimilation, etc., in the operation of the speech mechanism.

As previously indicated, in either psycho-acoustic or physiological terms the parameters involved in evaluating the various types of speech sounds will not all be the same. Vow-

els, nasals, fricatives, and plosives all have their characteristic physiological formations and their characteristic types of acoustical patterns. In the case of consonants there is often identifying information in adjoining formant positions. These consonant effects on the formants are called influences and have been found of considerable importance in reading visible speech. It is from such information as the influence that we are able to identify a final plosive when only the closure is made and no explosion ensues.

In the above described case of consonants we actually have a condition in which different types of parameters make essentially the same contribution to the identification of a phone. In the language of information theory there is a certain redundancy in the speech signal at this level. Some such redundancy is actually present in the signal in most forms depicted in Figure 2, which to a great extent explains why speech can undergo various types of deterioration to a marked degree and remain intelligible.

By definition the parameters at (b) specify the coordinates of the multidimensional phonetic space in which the phones of Figure 2(c) fall.

The phone is the minimum psychophysical region within phonetic space. The different forms apparent in Figure 3 and the discontinuities evident in Figure 2(b), however, indicate that the co-ordinates which are applicable may differ for the various speech sound classes. In other words, as the evaluation of a speech signal progresses in time different ones and different numbers of the co-ordinates of phonetic space may be involved.

The above phones of which we speak are the constituents of phonemes (*3, 2*). They are much greater in number than the phonemes and as such are not to be represented with the letters of an alphabet. They are best expressed in terms of values along the co-ordinates in the phonetic space in which they occur.

With regard to information theory, it is probably sufficient to note that step (c) involves sequences of symbols. This is the situation to which information theory most simply and directly applies. The theory provides us with the mathematical tools with which to treat the statistics of speech (*9*). It must be remembered, though, that information theory is not an experimental science; alone it cannot find the parameters with which a phone may be defined.

D. Between the identification of phones and the appearance of this information in the form of words occurs the phoneme stage, as represented by (d).

Certain procedures must be set up for assigning phones to phonemes. As stated earlier, any one phoneme will contain a large number of phones, and the manner in which these phones are grouped together will depend upon the ultimate objective. If the major purpose is the operation of devices by means of words, then possibly the phonemes should be classed on a dialectal or linguistic basis. If, however, the major intent is a phonetic typewriter, then a different grouping may be desirable. For example, the phones might be classed by a group of phoneticians in a consistent manner which systematically explored the limits of speech sound formations within the vocal tract. In essence, the grouping would probably respect the major distinctions found in most lan-

guages, rather than following a single dialect. Such a typewriter would recognize the differences among [i], [ɪ], and [y], regardless of whether these three sounds were all phonemically different in the dialect involved.

It is indeed interesting to speculate on the possible effects on speech if the above described phoneticians' phone groups were to serve as the basis for the design of speech controlled machinery. We must now consider, however, the classification of phones on a dialectal basis.

In any one language the number of phonemes is relatively small. Thus each phoneme is represented by a volume within phonetic space. As indicated previously, the allocation of this space to various phonemes differs tremendously in the various languages of the earth. In subsequent steps we shall want to group symbols into words, phrases, or sentences.

The grouping of phones into phonemes is a linguistic problem in many respects. In the construction of phonemes the linguist must attend to the meaning of words else he cannot know with what words he deals. The problem extends both to semantics and to dialect geography.

It is at this point that the inadequacies and the downright slovenliness of ordinary speech will probably first be fully appreciated. This factor, along with speech defects and dialectal differences, should combine to result in a rather forlorn sequence of symbols at (d). Yet such is the speech which we hear and interpret every day. At this point the importance of redundancy is again observed. There are phonetic laws that deal with allowed sequences of phonemes. For example, in English we never find [sbs]. There are also conditional probabilities in speech. From the corresponding phone we have one basis for identifying a phoneme, but in the sequences of phonemes themselves we have additional information which may be applied to any member of the sequence.

The use of this type of information actually requires a great deal of storage equipment. A practical device will probably represent a compromise between a limited storage of conditional probability information about phoneme sequences and the requirement that people speak distinctly in order to operate the device properly. Thus it is that there may not be a simple correspondence between each of the phones at (c) and the phonemes at (d). The number of phonemes in a given sequence may be somewhat less or somewhat greater than the number of phones in the corresponding sequence at (c). Further, conditional probabilities among the phonemes may require that certain phonemes be selected which do not contain the corresponding phones in the preceding sequence.

In the statistical study of speech sound combinations, there is actually much work to be done. For those with interests in applied phonetics the opportunities for study are considerable. The major need is for an extended phonetic or phonemic analysis of actual conversational speech. The laws of speech sound combinations are none too well presented in the literature; further statistical data on the actual occurrence of the various combinations of vowels and consonants, as taken from careful phonetic transcriptions and not from printed material, is urgently required.

At this point we may get some

further notion of the nature of the problem which has been described. Earlier we calculated that the maximum possible rate at which information could appear in the original speech signal was about 10^5 bits per second.

Now let us examine the information rate in terms of phonemes. Here we shall assume that within one dialect there is a total of 40 separate phonemes; that the maximum phoneme rate in the speech is 20 per second; and in order to obtain a maximum figure we shall assume no redundancy in the speech, that is, all 40 sounds are equally likely to occur.

$$H/\text{second} = 20 \log_2 40$$
$$= 106 \text{ bits/second}$$

E. It is possible that in many applications the construction of words, as shown at (e), could be omitted; that is, a device could be operated directly from the phoneme sequence. Such a sequence might represent nonsense syllables, a word, a phrase, or a sentence. Since the word is a very fundamental linguistic unit, however, it seems reasonable to assume that for general applications step (e) would be fundamental. In essence, the problem here is to separate the phonemes into appropriate groups to form words.

F. Though step (e) is by no means simple, the problems seem to be growing easier, and we would expect a good engineer to be able to design apparatus to carry us from properly identified words to the actual operations. It should be noted, however, that each word need not represent a single operation. Any single operation may be represented by various combinations and permutations of the words. The magnitude of the problem depends largely upon the nature of the operations which we wish to carry out.

The step represented by (f), however, becomes truly challenging when we think in terms of a highly flexible mechanism that can execute a wide range of commands, as contained in the meanings and the arrangements of the words derived from the stream of speech.

In conclusion it should be said that this discussion has been an attempt to describe the major steps required in the design of voice operated devices, and to show in a general way how information theory applies to these problems. There has not been time here, nor has it been the purpose of this discussion, to describe the actual research studies which appear necessary before the various processes can be adequately understood. It has been sufficiently emphasized throughout, however, that a considerable amount of fundamental research is yet required before properly functioning apparatus can be realized.

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Information Theory:

3. Applications Of Information Theory To Research In Hearing

Hallowell Davis

IN THE FIRST TWO papers of this symposium you have heard something about the nature of information theory from Dr. Weaver, and Dr. Peterson has discussed its application to research in experimental phonetics. Information theory is also applicable to research in hearing as I shall illustrate by two examples that I shall discuss in some detail. Perhaps in this way I can supplement Dr. Weaver's paper by illustrating some of the principles he has already set before you.

Last May a paper by Drs. Miller, Heise and Lichten (*9*) of the Psycho-Acoustic Laboratory at Harvard appeared in the *Journal of Experimental Psychology*. Its title is 'The Intelligibility of Speech as a Function of the Context of the Test Materials.' Information theory does not enter the authors' discussion in explicit mathematical form but the authors point out that their results are in qualitative agreement with the theory.

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The basic experiment was to determine the articulation functions for word lists or nonsense syllables heard against a background of noise. The intelligibility of the words was varied by varying the intensity of the noise. The 'context' was varied by varying the size of the vocabulary employed in the particular series of tests. Specifically, words were presented to a listener through a military intercommunication system and 'white' noise at various levels was also introduced at the earphones. For each type of test material the signal-to-noise ratio was varied systematically and the complete articulation function was determined. The functions for the various types of test material were then compared with one another.

Of course, the digits 'zero,' 'one,' 'two,' 'three,' etc., can be recognized in noise at much lower signal-to-noise ratios than words in sentences, particularly if the listener knows in advance that only the 10 digits are to be used as test items. Likewise words are recognized under more difficult conditions than nonsense syllables. For the latter each and every phoneme must be perceived correctly because the perception of one phoneme does not give a clue to the other phonemes

in the same syllable. Not only the relatively intense vowels must be recognized but the less intense consonants also. For the digits it is sufficient to recognize only the vowels. (Five was pronounced [fɑɪjəv] and nine was called [nɑɪnə]. In Miller, Heise and Lichten's experiment the thresholds (meaning 50 per cent correct) were at the signal-to-noise ratios of −14 db for the digits, −4 db for words in sentences, and +3 db for the nonsense syllables.

The authors' comments, couched in terms of information theory, are illuminating. They point out, for example, that various aspects of the stimulus, such as rhythm, accent, grouping, meaning, etc., that *did* occur seem to be less important than the characteristics of the stimulus that *could* have occurred but didn't. The most important variable that produced the differences was the *range of possible alternatives* from which the test item was selected. For the digits the range was only 10. For words the range was in the thousands and for nonsense syllables it was practically infinite. The authors suggest that a speech unit can be called 'intelligible' when *it is possible for an average listener with normal hearing to distinguish it from a set of alternative units*. Notice that in this definition 'the set of alternative units' is critical. The number of alternatives can be used to gauge the difficulty of the discrimination that must be made to recognize the item. This idea is actually the basis of Shannon's (*10*) system of measuring the *amount of information* in a message.

Miller, Heise and Lichten continued their experiment by using various sets of isolated monosyllables chosen at random from the phonetically balanced lists published by Egan. The talker read one word of the set and the listener selected from the set, which he had before him in typed form, the one which he thought he had heard. The sizes of the sets were 2, 4, 8, 16, 32 or 256; and finally a test was run with the entire 1000 words available but with no list before the listener. With a two-word vocabulary the threshold (after correction for chance selection of the proper item) was at −14 db signal-to-noise ratio. For the 256-word vocabulary it was at −4 db, while for unrestricted monosyllables it was at +4 db. Notice that by simply restricting the vocabulary the intelligibility of the average word was increased by 18 db.

An interesting comparison was made with the effect of simple repetition. When each word was repeated systematically three times the threshold was lowered by only 2.5 db. The authors conclude that far more improvement in communication is possible by standardizing both procedures and vocabulary than by merely repeating all messages one or two times. (Of course this principle had already been recognized in the context of military communications.)

My point in all this is that less information *needs* to be transmitted by the sound waves that represent a particular word if the choice of possible alternatives in the vocabulary is *restricted* than if the word must be distinguished from a large number of alternatives. When the noise was stronger and the signal-to-noise ratio was low many of the phonemes were wholly or partially masked, yet when the vocabulary was small most of the

words were still correctly identified. Less information reached the listener, in that he could hear fewer phonemes correctly, but not such precise discriminations were needed because there were fewer alternative choices. This general relationship is predicted by information theory, and the experimental result confirmed the prediction.

It may seem that to change the size of the vocabulary is a rather artificial way in which to alter 'context.' It has the advantage, however, that the change is independently measurable, and therefore the results can be compared quantitatively with theoretical predictions. Once the principles are clear we can use the method of determining the limiting signal-to-noise ratio to measure the importance of 'context' in its more usual sense. Miller, Heise and Lichten also did this by comparing the articulation curves for key words in sentences with the corresponding curves for the same words heard in isolation. The difference between the two thresholds, measured as the difference between the signal-to-noise ratios at which 50 per cent of the key words were correctly heard, was 6 db. This difference measures the effect of the context of those particular sentences on those particular words. The number '6 db' is not particularly important, but it is important that we have a *method* for measuring the effect of context, and also that the method rests on a firm theoretical foundation.

I have discussed a set of experiments on how the intelligibility of words is affected by context and vocabulary. The importance of such a restriction in making sounds intelligible I will illustrate once more by a personal experience. Some years ago (in 1935) I attended the International Physiological Congress in Leningrad. I was in the hotel room that I was sharing with three friends when the telephone rang. I was not expecting any call, from the OGPU or anyone else. I answered the phone, for the first time in Russia, and was assailed by a torrent of utterly unintelligible squawks and crackles. The instrument, I learned later, had been obtained from Germany as out-of-date equipment shortly after World War I. Its frequency characteristic must have looked like the cross section of an Alp rampant and the background of static was like a stone-crusher operating in a minor thunderstorm. I could hear an unintelligible voice in the midst of all of this; and I protested, in English, that I was Dr. Davis and did not speak Russian. The voice tried again, with no better success, until all at once I recognized an English word and realized what *language* the voice was speaking. The sounds were immediately transformed for me from nonsense syllables to English sentences, and my friend who was calling was able to make an appointment with me for dinner.

Research on hearing at the level of the physiologist also feels the impact of information theory, but it is a very different aspect that I find most directly significant here. I will illustrate by the influence on my own thinking of the ideas first clearly set forth by Gabor (*3*, *5*), particularly what he calls the 'information diagram' and 'elementary signals.' This kind of information is called (*8*) 'structural' information as opposed to the 'metrical' and the 'selective' aspects of information which deal with

the problems of noise, masking and alternative choices.

You are all familiar, I am sure, with two forms of graphic representation of an auditory signal. One of these shows the intensity of the signal as a function of time. This is the wave form of the signal as it is seen on an oscilloscope and is illustrated in Figures 4 and 5. The other, the so-called 'Fourier integral transform,' shows the intensity of the signal as a function of frequency. You know the 'frequency characteristic' of a hearing aid (Figure 1). The same form of representation is used to describe the distribution of energy in an auditory signal and is called the 'frequency spectrum' of the signal. The oscillogram and the frequency spectrum are directly related to one another mathematically and they represent limiting cases of Gabor's 'information diagram.' The oscillogram emphasizes *time* and the spectrum emphasizes *frequency*. The other dimension, the ordinate, in each case is the *intensity*. The Gabor information diagram is a

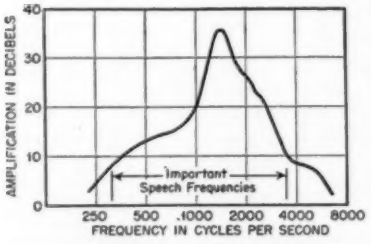

FIGURE 1. Frequency characteristic of a hearing aid, showing relative intensity (amplification) as a function of frequency. If this curve were the spectrum of an acoustic or electric signal it would indicate that most of the energy of the signal is carried by the frequency band between about 1000 and 3000 cycles per second. (From Davis, H., ed. *Hearing and Deafness*. New York: Murray Hill Books, 1947)

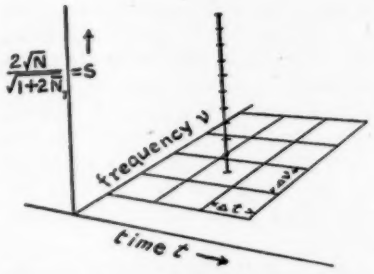

FIGURE 2. Three-dimensional representation of an arbitrary signal. After Gabor (*4*).

three-dimensional plot in which time, showing the duration of the signal, is represented on one axis; the frequency, showing the bandwidth, is on the second axis; and intensity is the third dimension at right angles to the other two (Figure 2). The oscillogram is the front view of this three-dimensional space, while the frequency spectrum is seen if it is viewed from the side.

If a signal is a pure tone, the duration must be infinite or the signal does not consist mathematically of a single frequency. At the other extreme is the 'delta function' or square wave front that rises abruptly and is therefore precisely located in time. Such a signal has mathematically an infinite bandwidth: all frequencies are equally represented. Each of these two signals, the pure tone and the delta function, are extreme cases. All other signals are somewhat extended in both time and bandwidth. They specify to some extent both the moment when the signal occurs *and* the frequency band that carries the energy. It is an interesting and important fact, however, that we cannot have a signal that is *precisely* specified both as to time and as to frequency simultaneously. This proposition follows

mathematically from the interrelationship between *time* and *frequency*. The latter is events (cycles) per unit of time. We cannot have our cake (time) and eat it too,—but we can use *some* of it to specify the *moment* and still save some of it to specify the *frequency band*.

The result is that our time-frequency diagram consists of rows of quantized cells whose dimensions are time ($\triangle t$) and frequency ($\triangle f$) (Figure 3), but the area of a cell cannot be reduced below a certain minimum. The cells, which Gabor calls 'logons,' may be made narrow to specify frequency closely, but then they must be long in time, or vice versa. The intensity dimension is, of course, the height of the block that stands on each cell as a base.

If we want to describe a complicated signal like speech we cannot profitably disregard any one of its three dimensions: time, frequency and intensity. All three of them are represented simultaneously in the 'Visible Speech' that Dr. Peterson has mentioned, and actually 'Visible Speech' comes very close to being a Gabor information diagram. The human ear deals very effectively with speech; and the information diagram much more nearly approximates the characteristics of the human ear than does either the wave-form or the frequency-spectrum method of representation (7).

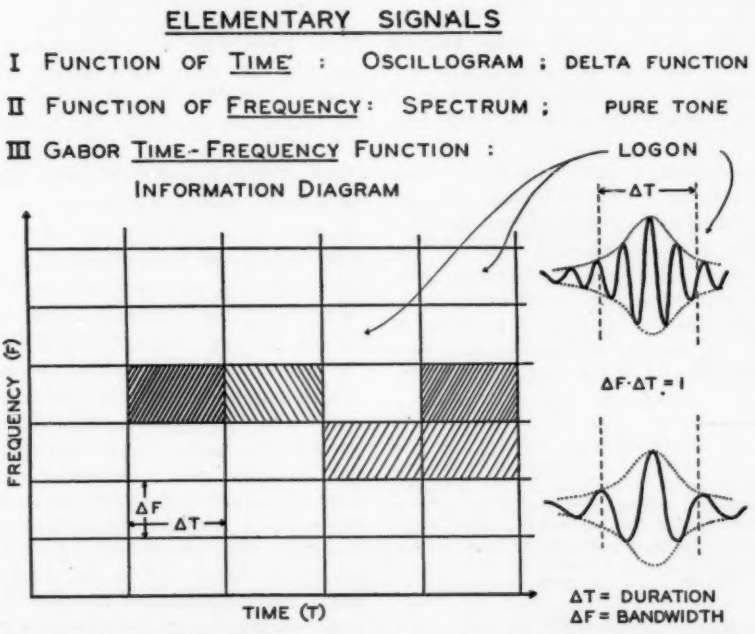

FIGURE 3. The information diagram and gaussian elementary signals. The envelopes (dotted lines) of the wave trains are intended to be gaussian probability functions. The intensity of the logons in the diagram is represented by the density of the shading, as in one form of 'Visible Speech.' For the definition of Δf and Δt see footnote in text. After Gabor (4).

The 'elementary signal' in Gabor's representation is neither a pure tone nor a square wave front but it is a compromise between the two. Let us look at the oscillogram of a logon (Figure 3). It has the form of a train of waves that rises to a maximum amplitude and then subsides again. The waves in the train occur at intervals that correspond to the frequency at the center of the cell. The shape of the rise and fall, that is the envelope of the train, is a Gaussian probability curve. This form of envelope gives the least possible overlap between the elementary signals and makes the area of a cell equal to the theoretical minimum. The effective duration ($\triangle t$) and the effective bandwidth ($\triangle f$) contain most of the signal; and the product of the two, which of course is the area, is equal to unity[1] which is the theoretical minimum. For example, if the effective duration is 20 milliseconds the effective bandwidth is 50 cycles per second. The product of these two dimensions is *one cycle* (not one cycle per second, but just 'one cycle')—an appropriate result for the size and dimension of an elementary signal. If the effective duration is increased to 25 milliseconds the effective bandwidth is reduced to 40 cycles per second. In order to reduce the effective bandwidth to one cycle per second the effective duration would have to be increased to one second.

As a neurophysiologist I have been working for 20 years on the relation between acoustic signals and the nerve impulses set up by them in the auditory nerve. Several years ago, before Professor Gabor sent me copies of his first papers on this subject, I thought that the ideal stimulus for study of the ear would be a single sinusoidal sound wave with no past or future. I wanted a signal that would stimulate the narrowest possible segment of the organ of Corti, and still I wanted it single so that it would set up one and only one volley of nerve impulses. I knew that I wanted the impossible and that a compromise of some sort was required, but I was not mathematician enough to tackle the problem theoretically. I got as far as recognizing empirically that there were certain advantages in fading the auditory stimulus in and out gradually, but Gabor showed just what the most efficient shape of fade-in and fade-out would be and also just how good the compromise could possibly be between precision in the *recognition of frequency* on the one hand and on the other hand the minimum duration needed for the 'frequency analysis.' He thereby told us what kind of signals we should use in our experiments.

For two years now we have been using brief acoustic signals, which we call 'tone-pips,' that approximate the form of Gabor's logons. We are just beginning to explore the effect of changing their shape and duration, but we do know that in the middle and high frequencies of the audible range we have come very close to my original desire. We are able to stimulate a rather restricted section of the

[1]This convenient and startling simplicity of the numerical value of unity for the area of a logon is achieved by the perfectly legitimate mathematical device of defining the effective duration and the effective frequency so that their product is unity. Actually

$$\Delta t = [4\pi\overline{(t-\bar{t})^2}]^{1/2}$$

and

$$\Delta f = [4\pi\overline{(f-\bar{f})^2}]^{1/2}$$

(See Gabor, 4).

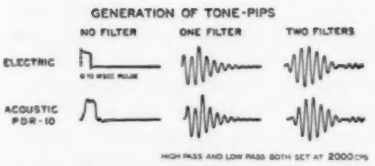

FIGURE 4. Oscillograms of electric and acoustic signals, showing transformation of a 'rectangular' pulse (left) to a tone-pip of approximately gaussian form. The filters employed are ordinary high pass and low pass electrical filters such as are used for 'sound effects.' Additional amplification is needed when the filters are employed. The distortion of the rectangular waves (no filter) is due to the electrical characteristics of the recording system and to the acoustical characteristics of the Permoflux (PDR-10) earphone (*2*).

organ of Corti and obtain a group of nerve impulses that are nearly but not quite synchronized into a single volley. We are thereby able to study and define the output of the ear more accurately than we could before.

Figures 4 and 5, taken from two of our recent papers (*1*, *2*) illustrate electrical tone-pips, acoustical tone pips, the corresponding electrical response of the inner ear, and finally the volleys of nerve impulses that ascend the auditory nerve. It is interesting to note in Figure 4 that we begin by sending a very brief pulse or a 'square' wave to a set of filters which transform the delta function into something very much like a logon of the desired mean frequency. The pip contains several waves, but its area in a Gabor information diagram is about one cycle, corresponding to the *single* original pulse. We have now paid for our restriction in frequency by extending the signal in time. The pip as an acoustical signal is received

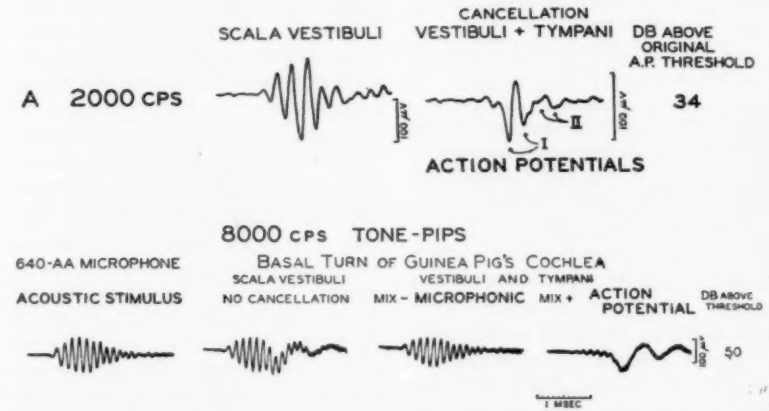

FIGURE 5. A. Electrical responses of the ear of a guinea pig to a 2000 cps tone-pip such as is illustrated in Figure 4. The response of scala vestibuli consists chiefly of the 'cochlear microphonic' which reproduces quite accurately the pattern of the acoustic stimulus. To the right are shown the action potentials which are revealed when the microphonic is eliminated by cancellation. Two major volleys of impulses are indicated by 'I.' At 'II' is seen the subsequent response of the cochlear nucleus in the brain stem.

Below, on a faster time base, are the acoustic stimulus, the mixed response, the pure microphonic response and the nearly pure action potential response to an 8000 cps tone-pip. The action potential consists of a single imperfectly synchronized volley (downward wave) from the neurons in the cochlea followed by a second smaller wave representing the response of the second-order neurons (*1*).

by the ear, and the part of the organ of Corti that it stimulates sends a *volley* (or a few volleys) of impulses up the auditory nerve. The volley corresponds to the 'one cycle' of the original pulse and of the logon. The nerve impulses are not synchronous, but are spread or grouped over several wavelengths. This is unavoidable, since we have confined the nerve impulses to those particular fibers of the auditory nerve that correspond to a certain part of the frequency spectrum. The volleys of nerve impulses carry some information as to frequency and some as to time, but neither kind of information is precise.

In addition to recording nerve impulses from guinea pigs' ears, we have listened ourselves to signals of this sort. They are brief clicks, taps, knocks or thuds. They have a curious *partial* quality of pitch which suggests to the listener the kind of material that is making the sound. By experience all of us have apparently 'learned the voices,' so to speak, of various implements and natural objects. All of our listeners describe the sound of high-frequency tone-pips as '*metallic* clicks.' As the frequency is progressively lowered they are likely to be called '*wooden* knocks,' '*watery* plops,' and '*sodden* thuds.' Everyone recognizes this change in quality as a kind of change in pitch, but it is difficult to match this pitch to the pitch of a pure tone (2). The partial, imperfect recognition of the 'effective frequency' is the price we pay for recognizing the signals as brief and abrupt, sharply located in time.

Actually the ear does remarkably well in recognizing the pitch of brief bursts of tone. I am speaking now of signals that are somewhat longer than our tone-pips but which, like Gabor's elementary signals, fade in and out gradually. Gabor has calculated, from the rather scanty experimental data that are available, that the resolving power of the ear and brain comes close to the theoretical limit. The product of the just-noticeable difference in pitch by the effective duration of a brief burst of tone is not very much greater than unity. But *how* the ear and brain manage to do this we do not yet understand.

It is remarkable that the ear does so well both for short logons and for long logons and also for middle-sized logons. Gabor points out that no single physical system could accomplish this. He infers that important nervous processes are involved in addition to the physical frequency-analysis in the inner ear. Huggins and Licklider (*6*) have given a theoretical hint as to the possible nature of such processes, but I cannot undertake to explain them here. My point is that information theory has led to clear suggestions as to the *kind* of process we should seek in the activities of the nervous system.

A final word about the information diagram. We are at liberty to choose long or short logons for our description. What length is best? Gabor suggests that for the description of speech a diagram with logons about 20 milliseconds long and consequently with an effective bandwidth of about 50 cycles per second is a good, although rough, compromise. This is approximately the bandwidth that was chosen for the 'high-definition' type of 'Visible Speech' at the Bell Laboratories (*11*). (You will recall that Visible Speech is essentially an information diagram with intensity represented by *brightness* of lights or *density* of shading.) This may well be the best single compromise if we must commit ourselves to designing a single

set of apparatus. I want to point out, however, that it is a *single fixed compromise*. The ear and brain can apparently perform their analysis in terms of *either* short logons or long logons. Presumably they can shift from one to the other or apply one method of analysis to one part of a complex signal like speech or music and the other to other parts. Perhaps a better form of Visible Speech would employ two analyzing systems simultaneously, one with high definition of frequency and the other with high definition of time and would superimpose the results of the two analyses in a single display. Here I am only speculating, but I am speculating on the basis of the profound respect I have acquired for the human brain and its sense organs.

It should be clear from these various examples that information theory has already had a very considerable and helpful influence on experimental work in hearing, both at the psychological and at the physiological level. It is much easier to obtain clear and meaningful experimental answers if we have a sound theoretical frame of reference that enables us to ask clear and meaningful questions.

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The Influence Of Vowels On Recognition Of Adjacent Consonants

Dorothy Sherman

ALTHOUGH IT IS known that intensity variation, including relations in intensity between speech and various masking noises, is one of the most important variables affecting the recognition of speech sounds, it seems reasonable to suppose that the interaction between speech sounds spoken in sequence may also have some influence upon their recognition by the listener. Studies of the harmonic structure of vowels have made it evident that variations in frequency of the resonant regions near the beginnings and endings of vowels may depend upon adjacent consonants. Fletcher (*1*) has stated that a consonant sound may sometimes be identified by the modification produced on the adjacent vowel even though the consonant is below the threshold as determined by an isolated consonant. The present article is concerned with the question of whether certain consonants spoken adjacent to certain vowels are more readily recognized than when the same consonants are spoken adjacent to certain other vowels.

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In order to select experimental speech sound stimuli it was assumed as a working hypothesis that if a consonant is spoken adjacent to a vowel whose physical pattern may be influenced or changed by that consonant, the change in the vowel may give an audible cue to the identity of the consonant. Thus, the basic problem was to investigate whether certain consonant sounds may be recognized, not only from acoustical characteristics inherent in the consonant sounds themselves, and, more particularly, not only as a function of intensity, but also from the influence of these consonant sounds upon preceding or succeeding adjacent vowels.

The hypothesis was tested by: (1) combining specific consonants with (a) vowels on which the consonant is thought to have a relatively large modifying influence and (b) vowels on which the consonant is thought to have little or no modifying influence; (2) using syllables containing the selected combinations as test stimuli to determine at varying levels of attenuation the differences in recognition of the consonant which accompany variation of the adjacent vowel; and (3) treating the resulting data by the technique of analysis of variance to determine whether it is reasonable to conclude that real differences exist.

The particular speech sounds chosen for study were six voiceless consonants, [θ], [f], [s], [ʃ], [t], and [p], and three vowels, [æ], [ʊ], and [i]. These sounds were selected specifically to make possible the combination of each consonant both with a vowel on whose physical pattern it is known to have a relatively large effect and with a vowel on whose physical pattern it is known to have a relatively small effect. Voiceless consonants were chosen rather than voiced consonants because there are, in general, larger differences in intensity between them and the vowels. To determine whether the influence of the consonant on the vowel is related to correct recognition of the consonant, the vowel must be clearly audible throughout the range of attenuation levels studied, and it is necessary that this range extend downward to attenuation levels at which the consonant has low audibility.

Selection of Speech Sound Stimuli

The technique of 'visible speech' (*3*) provided a method for selecting the consonant-vowel combinations to be used as speech sound stimuli. In the spectrogram, which presents a graphic record of the energy distribution of speech with frequency as ordinate and time as abscissa, the variations in frequency of the vocal resonances with time are conspicuously represented. The feature of immediate interest is the representation of the influence of phonetic context upon speech sounds. For particular consonant-vowel and vowel-consonant combinations there are characteristic shifts in the frequency location of the resonance regions of the vowel during its beginning or its closing phase. For other such combinations there is no apparent influence of the consonant on the spectrographic pattern of the vowel. The amount of such influence appears to vary with the particular consonant and the location of resonance bar 2 of the vowel with which it is combined. Resonance bar 2 plays a greater role in changing the total configuration of the visible pattern of the vowel than do any other resonance bars, and its location for a particular vowel is an indication of how much its visible pattern will vary because of the influence of various adjacent consonants. It seems plausible that there ought to be corresponding audible cues or lack of such cues during the transitional period from the consonant to the vowel and from the vowel to the consonant and that the presence of such cues might aid in identifying the consonant.

Six pairs of consonant and vowel combinations, with each consonant to occur in both initial and final positions, were selected in accordance with the above-mentioned considerations. The particular combinations, with the first vowel listed for each consonant being the vowel on which it might be expected to have the most influence and the second being the one on which it might be expected to have the least influence, were as follows: [t] with [ʊ] and with [æ], [f] with [i] and with [ʊ], [p] with [i] and with [ʊ], [θ] with [i] and with [æ], [s] with [i] and with [æ], and [ʃ] with [ʊ] and with [i].

A master test list of 200 nonsense syllables was constructed with the selected sound combinations occurring an equal number of times and with the consonant preceding and

succeeding the vowel an equal number of times. Precautions were taken to keep extraneous cues to the identity of a sound at a minimum by including all possible consonant and vowel combinations and also by employing consonant-vowel and vowel-consonant syllables as well as the consonant-vowel-consonant type. It seemed possible that, if the listener expected all syllables to be of the consonant-vowel-consonant type, he might have a tendency to supply one of the consonants of lower phonetic power when he did not hear a consonant in the initial or final position.

Equipment

The block diagram of Figure 1 shows the physical layout of the instrumentation used for recording the test stimuli and for conducting the experimental listening sessions. Also indicated are the intercommunication equipment, the electronic timing device used to ensure the desired spacing of the recorded syllables, and the experimenter, speaker, and listener positions.

A Presto RC 10/24 tape recorder and an Electro Voice, Model 650, microphone were used for recording the speech sound stimuli at a tape speed of 15 inches per second. An auxiliary monitoring circuit enabled the speaker to secure a relatively constant input level and also made it possible for the experimenter to check on the constancy of the level maintained.

The testing circuit for the experimental listening sessions consisted of: (1) the Presto RC 10/24 tape playback; (2) a McIntosh amplifier, Model 20W2; (3) two Hewlett Packard, Model 350-A, constant impedance attenuators in series; (4) an earphone circuit consisting of six PDR-8 Perm-

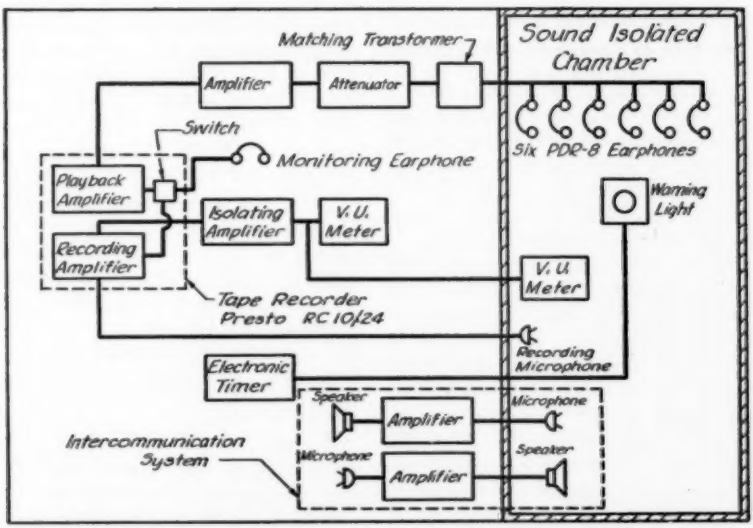

FIGURE 1. Schematic diagram of instrumentation for recording test stimuli and for experimental listening sessions.

oflux earphones arranged for monaural listening; and (5) a UTC H-A 108 matching transformer to provide an impedance match between attenuators and earphones. A pair of earphones connected across the tape playback amplifier enabled the experimenter to monitor the listening tests and to know when to attenuate the signal strength reaching the listeners' earphones as required by the conditions of the experiment.

Experimental Procedure

Three male speakers, each judged to have normal voice quality and distinct articulation, were employed to record the nonsense syllables to be used as test items. A check on constancy of recorded voice level was made on a random sample of 150 syllables for each speaker by means of a Hewlett Packard, Model 400-A, VTVM connected across the playback amplifier. Constancy of recorded voice level as measured by standard deviations in decibels was almost identical for the three speakers and was considered highly satisfactory; in each instance the standard deviation was less than one decibel. There were slight differences in recorded voice level from speaker to speaker, however, and provision was made for eliminating these differences on tape playback. Constancy of mean signal strength of the test stimuli from tape to tape and from speaker to speaker was accomplished by adjusting to a predetermined zero reference level the output voltage of a 500-cycle oscillator reference tone which had been recorded to match the mean level of the recorded syllables for each tape.

By means of tape playback the syllables were presented at four-second intervals to six normal-hearing,[1] trained observers, all of whom were graduate students in speech pathology and audiology. They listened monaurally in a sound isolated room and recorded their responses in phonetic symbols. Attenuation levels were in randomized order and differed with each block of 20 syllables. The listeners were given full knowledge of the consonant sounds for which they were to listen, of the vowels which would occur in the syllables, and of the variation in number and position of consonants in the syllables. This instruction was given to facilitate learning during the practice sessions which were held both for the purpose of learning the experimental tasks and for the purpose of stabilizing judgments in order that learning effects might not influence the experimental data unequally. Listeners were also instructed that there were to be no doubtful judgments. That is, they were told to omit recording a phonetic symbol for any position in a syllable only on the judgment that no sound had been presented in that position.

Repeated recordings of the master test list of 200 syllables with the syllables randomized for each repetition provided 13 judgments on each sound combination by each listener for each speaker at each of 10 intensity levels over a range of 40 decibels. Thus, on the graphs relating per cent recognition to attenuation level (See Figures

[1]Each listener had normal hearing as measured by the pure tone audiometer with the criterion of no departure from the normal level of the audiometer greater than 10 db at any frequency.

2 and 3) there were, for each speaker, 78 judgments for each point plotted, and for the composite function for all three speakers there were 234 judgments for each point plotted.

Analysis

The results of the listener judgments for each speaker for each consonant in the 24 consonant-vowel and vowel-consonant combinations stud-

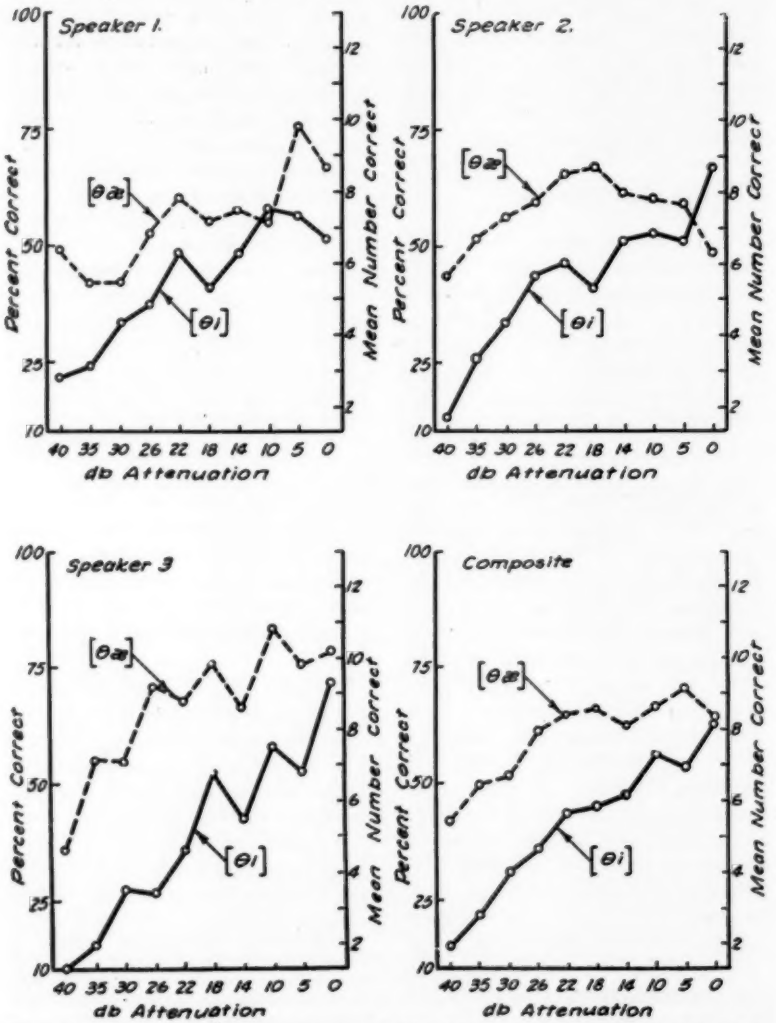

FIGURE 2. Trends of recognition means of initial [θ] in combination with [i] and in combination with [æ] at 10 intensity levels.

ied were represented graphically as shown in Figures 2 and 3. The zero reference level of the abscissa is for all graphs an arbitrary level determined by the gain of the playback system. A composite graph based on the data for all three speakers for each consonant in each combination was plotted except in the instance of obvious inconsistencies among speakers. The solid line connects the plotted points representing correct recognition of the consonant in a sound combination for which the working hypothesis would predict that the influence of the consonant on the vowel would increase the per cent recognition. The broken line connects points representing judgments on a sound combination for which the working hypothesis would predict little or no such influence. These lines represent the trends of consonant recognition means as a function of change in attenuation level and in the ensuing discussion will be referred to as recognition trend lines.

The basic problem is whether, for any pair of sound combinations studied, the two recognition trend lines are different. For instance, the trend lines representing recognition of [θi] and [θæ] for Speaker 3 as shown in the lower left-hand corner of Figure 2 are obviously separated. The question to be answered, by appropriate statistical analysis, is whether these trend lines may be said to be separated by a statistically significant amount or whether the separation can reasonably be attributed only to chance variations in the listeners' responses.

The data were evaluated by the technique of analysis of variance. A three-dimensional factorial design was employed in which the factors were attenuation levels (A), speakers (S), and listeners (L). The fourth factor, the experimental variable of sound combinations, was included within the criterion measures, since each criterion measure was a difference between two recognition scores on a pair of sound combinations for one listener and one speaker at one intensity level. An analysis of the trends of the means of criterion measures was employed to evaluate the hypotheses which the study was designed to investigate. Essentially, the statistical analysis is the one outlined by Lindquist (*2*) for use with a treatments × intervals × subjects design.

Statistical Tests of Speaker Differences. To discover whether it is reasonable to assume that the per cent recognition of a consonant depends upon the adjacent vowel, several statistical hypotheses must be tested. It is first required to know whether there are significant differences among speakers since this is the deciding factor in determining whether it is reasonable to pool data for all three speakers or whether the final tests for differences in recognition of sound combinations should be performed for each speaker separately.

To determine whether the trend of attenuation means (which represent the mean differences between the two main conditions of the experiment at varying attenuation levels) may be assumed to be the same for all speakers, two hypotheses must be tested. The first test is concerned with the hypothesis that the A-trend lines[2] for

[2]An attenuation trend line, referred to in this discussion as an A-trend line, would be represented graphically by a line connecting the means of criterion measures plotted as a function of attenuation level.

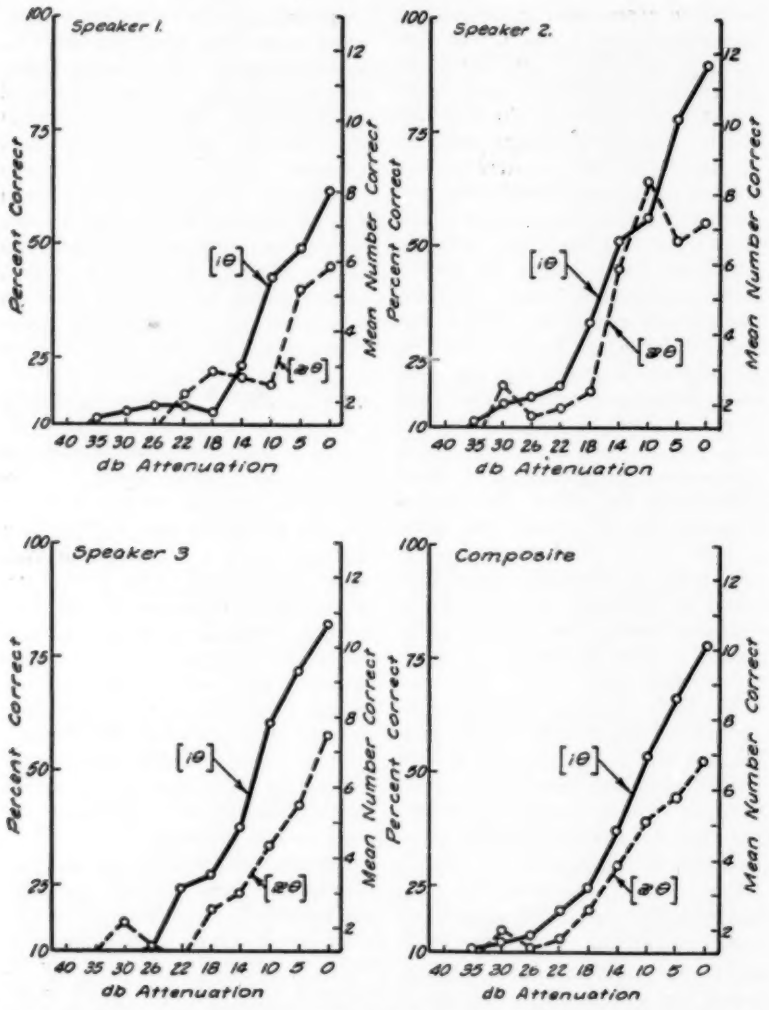

FIGURE 3. Trends of recognition means of final [θ] in combination with [i] and in combination with [æ] at 10 intensity levels.

speakers are parallel, that is, follow the same pattern. The appropriate test is

$$F = ms_{A\times F}/ms_{A\times S\times L},$$

the purpose of which is to determine whether or not the observed differences in trend from speaker to speaker can be accounted for entirely in

terms of random sampling from a population of listeners in which there are no mean trend differences for speakers.

If the hypothesis is tenable that the A-trend lines for speakers follow the same pattern, it is still necessary to test the hypothesis that the lines coincide. This hypothesis is tested by

$$F = ms_S / ms_{S\times L},$$

the purpose of which is to determine whether the differences among speaker means can be accounted for entirely in terms of random sampling from a population of listeners in which these means are identical.

Since the latter hypothesis could be true even though the first were false, the test for the same pattern is applied first. If either of these hypotheses must be rejected, the data for each speaker are treated separately. If both are tenable, the data for all speakers are pooled.

Statistical Tests of Differences between Recognition Trend Lines. The appropriate F-ratio for testing the main effect of intensities is as follows:

$$F = ms_A / ms_{A\times L},$$

the purpose of which is to determine whether the differences among criterion measure means at the various attenuation levels can be accounted for entirely in terms of random sampling from a population of listeners in which these means are identical. That is, the F-ratio provides a test of whether the recognition trend lines as represented graphically in Figures 2 and 3 follow the same or different patterns. This is actually a test of the interaction between sound combinations and attenuation levels. In other words, the test determines whether the criterion means, which measure the differences between the recognition trend lines at varying levels of attenuation, are the same or different. Thus, if the result of this test is significant, it may be assumed that the recognition trend lines follow different patterns and no further test is necessary.

If the result of the above test permits the assumption of no interaction between sound combinations and intensities, however, the trend of consonant recognition may be assumed to have the same pattern for each of the two sound combinations being considered. In this case it is still necessary to determine, by testing the hypothesis that the mean of successive differences is zero, whether the trend lines may be assumed to be separated by significant amounts. To test this hypothesis, a value of t is obtained, as follows:

$$t = G.\,M. / (ms_L / N)^{1/2},$$

where $G.\,M.$ = general means of criterion measures, ms_L = mean square for listeners or the estimated variance for a population of listeners, and N = total number of criterion measures. In this test the number of degrees of freedom is the number of listeners minus 1.

In analyzing the data for one speaker separately, the test of the effect of attenuation levels and the t-test are employed in the same fashion as described above. That is, the data for one speaker are evaluated through an attenuation levels $\times$ listeners design.

Attenuation Levels Included in the Analyses. In no instance are the ob-

TABLE 1. Results of analysis of variance, comparing [θi] with [θæ].

Source of Variation	*df*	*ss*	*ms*	*F*	*p**
Attenuation Levels (A)	8	119.16	14.895	2.02‡	NS†
Speakers (S)	2	99.12	49.560	2.97§	NS
Listeners (L)	5	1079.36	215.872		
A × S	16	93.15	5.822	< 1.00‖	NS
A × L	40	294.25	7.356		
S × L	10	166.73	16.673		
A × S × L	80	530.33	6.629		
Total	161	2382.10			

	General Mean	*t(df=5)*¶	*Level of Significance*
Entire Table	—2.45	2.123	.10

*point in the *F*–distribution.

†Not significant.

‡$F = ms_A / ms_{A\times L}$.

§$F = ms_S / ms_{S\times L}$.

‖$F = ms_{A\times S} / ms_{A\times S\times L}$.

¶$t = G.\,M. / (ms_L / N)^{1/2}$, where N = number of criterion measures and $G.\,M.$ = general mean.

tained data for all 10 attenuation levels included in the analysis. To satisfy the underlying assumptions necessary in any analysis of variance, it is impossible to include the data for those portions of the attenuation-scale along which correct recognition reached or closely approached zero or 100 per cent. The number of attenuation levels for which data are included in the analyses varies from four to nine.

Results of Analyses of Variance

Differences among Speakers. Since the speakers were all trained in speech and were judged to have normal voice quality and distinct articulation, it was not anticipated that significant differences among them would be found. In only four instances, however, was it possible to make a final comparison of consonant recognition trends on the basis of the initial three-factor analysis of variance alone (See Table 1 for an example).

Among the remaining eight analyses, five yielded results[3] indicating that the pattern of attenuation means could not reasonably be assumed to

[3]To interpret these results, it is necessary to keep in mind the nature of the criterion measures, that they indicate differences in correct recognition between two sound combinations.

be the same for all speakers (See Table 2 for an example). That is, the pattern of differences in recognition is not the same from speaker to speaker, and the attenuation level associated with the largest difference in recognition is not the same from speaker to speaker. It seems reason-

TABLE 2. Results of analysis of variance, comparing [iθ] with [æθ].

Source of Variation	*df*	*ss*	*ms*	*F*	*p**
Attenuation Levels (A)	6	132.93	22.155		
Speakers (S)	2	42.87	21.435	2.19‡	NS†
Listeners (L)	5	85.47	17.094		
A × S	12	126.69	10.556	2.22§	.05
A × L	30	123.26	4.109		
S × L	10	97.79	9.779		
A × S × L	60	285.98	4.766		
Total	125	984.99			
(Speaker 1)					
A	6	65.24	10.873	3.04‖	.05
L	5	78.50	15.700		
A × L	30	107.33	3.578		
Total	41	251.07			
(Speaker 2)					
A	6	123.90	20.65	4.24‖	.01
L	5	54.57	10.914		
A × L	30	146.10	4.870		
Total	41	324.57			
(Speaker 3)					
A	6	70.48	11.747	2.26‖	NS
L	5	50.19	10.038		
A × L	30	155.81	5.194		
Total	41	276.48			

	General Mean	*t(df=5)*¶	*Level of Significance*
Speaker 3	2.19	4.478	.01

*point in the *F*–distribution.

†Not significant.

‡$F = ms_S / ms_{S\times L}$.

§$F = ms_{A\times S} / ms_{A\times S\times L}$.

‖$F = ms_A / ms_{A\times L}$ (computed for one section of table only).

¶$t = G.\ M. / (ms_L / N)^{1/2}$ where N = number of criterion measures and $G.\ M.$ = general mean.

able that these significant results may be due, at least in part, to uncontrolled sources of variance,[4] which are almost certain to have an important influence on listener judgments of the kind upon which this experiment is based. Such influences are apparent in the fairly pronounced reversals which may be seen in the graphic representations of correct consonant recognition.

Another possible contributing factor to difference in pattern of attenuation means may, in some instances, stem from differences in intelligibility from speaker to speaker. Attenuation means are represented graphically, as in Figures 2 and 3, by the amount of separation, including direction of separation, of the recognition trend lines at the various attenuation levels. An examination of the graphical representations of recognition trend lines shows that at relatively high levels of intelligibility the direction of differences between trend lines is unstable. Thus, if intelligibility differs from speaker to speaker, a difference in pattern of attenuation means seems likely. The relatively higher intelligibility of Speaker 2 is apparent in several instances, the most extreme of which are for consonants [t] and [ʃ].

The remaining three analyses permit the assumption of no significant differences among speakers insofar as pattern of A-trend lines is concerned but do not permit the assumption that the main effect for speakers is zero. For the comparisons of [ʊp] with [ip] and of [sæ] with [si], although the hypothesis of no difference among speakers is untenable, the A-trend lines do not differ significantly in pattern and furthermore the differences between recognition trend lines are in the same direction for all three speakers. Hence, one is free to assume that the differences are of degree and not in kind. Only for the comparison of [is] with [æs] do the results show a combination of: (1) no difference among speakers for the pattern of the A-trend lines; (2) a significant difference among speakers in the separation of the A-trend lines; and (3) separation of the recognition trend lines which differ in direction from speaker to speaker. The treatment of the data separately for each speaker yielded the only results indicative of significant reversal among speakers of the vertical placement of the recognition trend lines.

Differences between Recognition Trends. In general, the results indicate that the recognition of consonants may be affected by variation of the adjacent vowel. Summarized in Table 3 are the sound combinations and corresponding speakers with results significant at the five per cent level.

The only consonant for which there are no significant results is [f]. For the consonant [θ] significance of the results varies with position of the consonant in the syllable. With reference to the non-significant results for [θ] in initial position, it is of interest to note (See Figure 2) that the vertical separation of the recognition trend lines is in the same direction for all three speakers and that in the composite graph the trend lines do not cross at any point. The lack of significant results may be explained by the fact that the among

[4]Sources of variance which affect all listeners alike would not be taken into account in the error term of this test.

TABLE 3. Summary of results significant at the five per cent level. The first of each pair of sound combinations is the one for which the higher per cent recognition of the consonant was predicted. The symbols $>$ and $<$ indicate for which sound combination of each pair the higher per cent recognition of the consonant was obtained.

Recognition of:	*Results for:*
[iθ] $>$ [æθ]	Speakers 1, 2, and 3
[pi] $<$ [pʊ]	Speakers 1, 2, and 3
[ip] $<$ [ʊp]	Speakers 1, 2, and 3
[tʊ] $<$ [tæ]	Speaker 1
[ʊt] $>$ [æt]	Speakers 1 and 3
[si] $<$ [sæ]	Speaker 3
[is] $<$ [æs]	Speaker 1
[is] $>$ [æs]	Speaker 3
[ʃʊ] $>$ [ʃi]	Speakers 1, 2, and 3
[ʊʃ] $>$ [iʃ]	Speakers 1, 2, and 3

listeners variability, as indicated by the mean square for listeners (See Table 1) is very large.

In the remaining eight analyses, final tests concerned with the hypothesis of no difference between recognition trend lines are significant at the five per cent level with the exception of four results for Speaker 2, one result for Speaker 1, and one result for Speaker 3. A possible explanation for a difference between Speaker 2 and the other two speakers has already been discussed. It seems likely that fewer non-significant results might have been obtained for Speaker 2 if the data for this speaker had extended downward to lower levels of per cent recognition. In general, the results from speaker to speaker are consistent in direction. Specifically, the separation of the recognition trend lines is in the same direction from speaker to speaker for any consonant for which significant results were obtained on the final tests concerned with the separation of these trend lines except in a single instance already mentioned (comparison of [is] with [æs]).

The results do not permit the assumption that the influence of vowels on recognition of adjacent consonants is independent of consonant position in the syllable. For three of the six consonants studied there are reversals in the direction of separation of the recognition trend lines accompanying change in consonant position (See Figures 2 and 3 for an example).

Further research is needed before any adequate explanation of these variations with position can be offered. It seems possible that differences in duration and differences in intensity might vary both with change of the vowel and with position of the consonant, although no evidence can be cited on the basis of existing research. Certainly the single hypothesis concerned with changes of the physical pattern of the vowel lacks plausibility.

Although, in general, the evidence obtained supports the hypothesis that the per cent recognition of certain

voiceless consonants changes with variations of the adjacent vowel, there is no evidence that predictions made by the method employed to select the consonant and vowel combinations for this study will be correct. That is, there appears to be no relation between recognition of the consonant and the relative degree of modifying influence of the consonant on the vowel as reflected by the amount of variation of bar 2 of the vowel spectrogram. Only for the one consonant [ʃ] are the results both significant and consistently in the direction predicted. The results for [θ] and for [t] in final position also are consistently in the direction predicted and are significant at the five per cent level with a single exception for one speaker. In three instances results fail to show significant differences between recognition trends. For one comparison, differences for two speakers, although significant at the five per cent level, are inconsistent in direction. The differences in the remaining four analyses are consistently in the direction opposite to that predicted and are significant at the five per cent level with four exceptions for individual speakers.

Since recognition of the individual phonetic elements of speech varies as a function of sound pressure level, it is pertinent to consider whether the particular vowel with which a consonant was combined had an effect on its relative sound pressure level. It is known that the fundamental speech sounds are produced in conversation with varying degrees of power. Consequently, in monitoring several vowels to the same level, the speaker may find it necessary to use more effort for producing one vowel than for another. Thus, it seems possible that the level of a given consonant might vary with the adjacent vowel relative to the effort necessary to monitor the vowel. There were differences among speakers, however, with respect to the particular vowels requiring the most and the least effort to monitor. That this was true was indicated not only by the subjective reports of the speakers but also by the observations of the experimenter. Thus, since the direction of separation of recognition trend lines for each consonant studied (except for [s] in final position) is consistent among speakers, it seems indicated that any differences in the relative level of a consonant dependent upon the monitoring of adjacent vowels had no important effect upon the results.

Further evidence may be seen in the results for differing consonants in combination with like pairs of vowels. The consonants [f], [p], and [ʃ] were each presented in combination with [i] and with [ʊ]. Although the consonants [p] and [ʃ] were significantly more often recognized in combination with [ʊ], no significant differences were found for the consonant [f]. Also, [i] is typically the least intense of the three vowels (*4*) and for two of the speakers did require more effort to monitor than did the other two vowels. Thus, the direction of difference between recognition trends for these two consonants is contrary to what might be expected if monitoring had an important effect on consonant sound pressure level. Additional similar evidence could be cited in regard to the combination of the consonants [θ] and [s] with the vowels [i] and [æ] and also in regard to reversal of direction of separation of recognition

trend lines with position in the syllable.

Discussion

In the main, the results support the general hypothesis that there is variation in the per cent recognition of a consonant concomitant with variation of the adjacent vowel. There is, however, no evidence to support the particular hypothesis which served as the basis for the selection of consonant and vowel combinations to be studied, that is, that the variation in consonant recognition may be predicted by the effect of the consonant on the physical pattern of the vowel as shown by an inspection of the amount of variation of bar 2 of the vowel spectrogram. No explanation is offered to account for significant results contradictory to predictions based on this hypothesis. If there is an influence on consonant recognition dependent upon variations in frequency of the resonant regions near the beginnings and endings of adjacent vowels, more extensive research with a larger number of sound combinations and a more detailed study of the effect of adjacent consonants on vowel spectra variations is needed to determine the nature of this influence. Since the results are not in accord with the predictions made, it is entirely possible that comparisons based on a different selection of vowel and consonant combinations would reveal even larger differences.

That a major source of variation in intelligibility testing arises from the differences among listeners is demonstrated by the relatively large mean squares for listeners obtained in the analyses of variance. It should be noted that a large absolute amount of separation of recognition trend lines (See Figures 2 and 3 and Tables 1 and 2) does not necessarily mean that the difference characterizes the whole population of listeners. The test of significance must take into account the amount of variability among listeners. Thus, pooling data for listeners without taking into account the differences among them, which has been the practice in some previous research concerned with the auditory perception of speech, would appear to be contraindicated.

Differences among speakers were also shown to be significant in a number of instances. In view of these results, it may be stated that, in general, data for speakers should not be pooled without first determining by means of appropriate statistical procedures that differences among them may be assumed to be non-existent.

It has already been pointed out that position of the consonant in the syllable is a factor which, in some instances, may significantly influence the differences which will be found when two combinations composed of one consonant and two different vowels are compared. Since it is also known and is apparent from the experimental results that the per cent recognition of a consonant in one particular sound combination may vary with its position in the syllable, it seems clear that data on recognition of a consonant should not be pooled without regard to the position in which the consonant occurred as well as the particular vowel with which it was combined, and that discussion of such data necessitates reference to the same factors.

Problems concerned with auditory perception of speech are of interest to speech correctionists, to those

whose primary concern is with the hard of hearing, to psycho-acousticians, and to communications engineers interested in equipment for the transmission of speech. Although the findings of this investigation are too limited in scope to have direct practical implications for purposes of intelligibility testing, it seems indicated that further research to determine the exact nature of the interaction of speech sounds spoken in sequence would have such practical implications.

Summary

This article concerns the influence of vowels on recognition of adjacent consonants. To select consonant and vowel combinations for test stimuli it was assumed that per cent recognition might depend upon the relative effect of the consonant on bar 2 of the adjacent vowel in the spectrogram. Per cent correct consonant recognition as a function of attenuation level was investigated for each of six voiceless consonants in combination with (1) a vowel on whose spectrographic pattern it has a relatively large effect and (2) a vowel on whose spectrographic pattern it has a relatively small effect. The obtained data were determined by the responses of six observers to nonsense syllables recorded by three male speakers. Significance of the difference between trends of recognition was evaluated for each consonant, both in initial and in final position, by analysis of variance. On the basis of experimental findings it may be stated: (1) The per cent recognition of the consonant may depend upon the adjacent vowel. (2) The per cent recognition of the consonant does not depend upon change in the physical pattern of the adjacent vowel as reflected by the consonant influence on the position of bar 2 of the vowel spectrogram.

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A Recorded Warble Tone Audiometer Test Suitable For Group Administration Over Loudspeakers

John C. Webster

IN ORDER TO better appreciate the difference between the group audiometer test to be discussed and previous group tests of the pure tone type, a brief summary of previous tests will be presented. According to Myers, Harris, and Fowler (5):

> Group audiometry with the use of pure tones was apparently first investigated by Munson (*4*), who demonstrated that a group test of acuity, with self-recorded responses, could be made simple enough to eliminate nearly all administrative and scoring errors.

The now familiar procedure was to have the subjects, who listened over a multiple headset network, record how many pulses of tone they heard at lower and lower intensity levels. Table 1 presents the details of such a test.

John C. Webster (M.A., Iowa, 1943) is a research psychologist with the Psychophysics Branch of the Human Factors Division, U. S. Navy Electronics Laboratory, San Diego, Calif. This article is adapted from a paper presented at the 1950 Annual Meeting of the American Psychological Association, State College, Penna. These tests involved the cooperative work of many members within the Human Factors Division. Special mention should be made of H. R. Beitscher, who assisted in setting up many of these mass tests. Technical and editorial assistance was provided by R. S. Gales, head of the Psychophysics Branch, and Dr. A. M. Small, head of the Human Factors Division.

A test of this type, using pulses of tones, was recorded on a phonograph record and used at the 1938 World's Fair (*9*). In this test the attenuation was done externally, it was not incorporated on the phonograph record itself. The Navy Electronics Laboratory used a similar test at the 1948 San Diego County Fair (*10*). The additional factor of incorporating the attenuation between successive test items on the phonograph record was utilized at the San Diego Fair.[1]

Harris (*2*) utilized the pulsed-tone technique for group testing by manually keying an audiometer to which multiple headsets were attached. The test administrator follows a given pattern of pulses through a descending and ascending order of intensities for each frequency. The observer writes down the number of pulses he hears in the appropriate space on an answer sheet.

Nielsen (7), in Denmark, used a similar system on groups of school children. Instead of presenting from one to four long pulses for any given test item, however, he presented a four-digit code group of dots (short

[1]Subsequently, a patent covering the use of this type of test, recorded on a phonograph disc, has been issued to H. B. Shaper of the Sonotone Corporation (#2,511,482: 13 June 1950).

TABLE 1. Basic design of the usual group pure tone hearing test, showing, for a typical group of 10 items that might be used at any one frequency, both the number of pulses per item and the intensity of each pulse in db above zero hearing loss. Various modifications are listed.

Item	*Schedule*			*Alternatives or Additions*
1	40	40	40	1. Use descending series only, and in 5 db steps.
2	30	30		2. Use 5 db descending series only, and repeat it.
3	20	20		3. Use same steps in ascending series as in descending.
4	10			4. Use warning lights when tones may be sounding.
5	0	0	0	5. Use a greater (or smaller) range of hearing loss steps with the different frequencies to be tested.
6		omit		
7	5	5	5	
8	15			
9	25	25		
10	35			

pulses) and dashes (long pulses), and he used only the descending intensity series.

Gardner (*1*) showed that the pulsed-tone technique when used by a clinical audiometrist testing people individually was slightly more reliable and equally as valid as the standard method. It was also judged to be more pleasing to the listener and more attractive for the operator. Concurrently, Reger and Newby (*8*) used the same system as a group testing instrument. In both of these latter cases the pulsing was done automatically either by electronic or mechanical means. Both added modifications to existing audiometers and both used a warning light to alert the listener during the period the pulsed-tones were on.

All of the tests so far described have two things in common: (1) They used 40 or fewer individual headsets, and (2) all pulses in a given test item are at a given intensity and the new series of pulses at another level (usually lower).

Preliminary Trials of NEL Recorded Tests

The question arose as to whether or not this type of test could be given over loudspeakers to groups of people as large as one or two hundred. Preliminary tryouts at the Naval Training Centers at San Diego and Great Lakes showed that although obvious faults existed the general idea was feasible.

The noise environment of the testing rooms turned out to be a greater problem than the non-uniformity of the sound field. The noise was of two main types: (1) external, that coming

from such things as airplanes, trucks, marching men, etc., and (2) internal, that generated by the people taking the test. The descending order of intensities was such that threshold was reached by the majority of men at approximately the same time. Any uncontrolled noise at this critical point in time tended to mask out, or at least distract, the individual so that he might miss that item and made it highly unlikely that he would pass the following item. Some of the most noticeable noises of this sort were the sudden release of air from the lungs after the effort to hear the near threshold item, the unconscious shift in postural position, the clearing of throats, and other movements of a relaxing nature.

The differences in measured hearing loss that could be attributed to the man's position in the room were less than the physical measurements of sound maxima and minima would seem to indicate. This might be accounted for by the fact that the tests were binaural and the men were free to move their heads, or by the slight frequency modulation introduced by the playback turntable, or it may have been due to the fact that the noise environment was such as to obliterate the small differences attributable to room position.

The test-retest reliability of these tests was directly related to the amount of noise in the rooms. In the one instance where the noise level was sufficiently low the reliability was as good as had been reported on other group tests. The Harvard Auditory Test No. 12 (*3*) was used as a validating measure, and its reliability was on the same order of magnitude as the pure tone test, when both were given over loudspeakers. The comparison between the two tests, which was used as a validating measure, was as good as could be expected, consistent with the reliability of each.

It was apparent that the pure tone test was not completely satisfactory when given over loudspeakers but it was equally apparent that the general idea was feasible.

The most glaring defect of the test was its dependence upon one point in time in determining a man's threshold. That is, the intensity of each succeeding item decreased until the intensity was below threshold. A cough, a passing truck, or any noise within a five-second interval near threshold could cause a change of five db or more in the threshold measure. It was also apparent that very often the near-threshold tones were not really masked by the noise, but the annoyance or distraction value of the noise was such as to make many just give up in despair.

A new test was designed which (1) used warble (or frequency modulated) tones instead of pure (or sine wave) tones and (2) crossed a person's threshold five times. The design of the test and the method of recording the answers is shown in Table 2. In this test each pulse within a test item is softer than the one before it. Five different levels are chosen, one at threshold, one 10 db above (louder than) normal threshold, called a 10 db hearing loss, and the other levels at hearing loss values of 20, 30, and 40 db. The first test item in the example shown thus has the first pulse at a level 40 db above normal threshold followed by other pulses at 20, 10, and 0 db, respectively, above normal threshold. The series of 10 items used to determine threshold at any one frequency is chosen so that each of

TABLE 2. Basic design of the Navy Electronic Laboratory group recorded hearing test, showing, for a typical group of 10 items, both the number of pulses per item and the intensity of each pulse in db above zero hearing loss. Typical responses of persons with 0, 10 and 6 db hearing loss are also shown.

Item	*Schedule*				*Typical Responses*		
					0 db loss	*10 db loss*	*6 db loss*
1	40	20	10	0	////	///	///
2	30	20			//	//	//
3	40	20	10	0	////	///	///
4	40				/	/	/
5	30				/	/	/
6	40	20	0		///	//	///
7	30	10			//	//	//
8	30				/	/	/
9	40	20	10	0	////	///	///
10	30	10	0		///	//	///
			Total Correct		25	20	22

the five levels will be sounded five times. Thus, there are five pulses at a 40 db level, five at 30, etc. This provides that anyone with a hearing loss of not greater than 35 db nor less than five will have five opportunities to hear the pulses on either side of his threshold.

The answers are recorded by making a mark for every pulse heard. A perfect score, or no hearing loss, is shown in the first 'Typical response' in Table 2. The second example shows the ideal case of a person who could hear all levels except the softest or zero level. He is classified as hearing 10 db worse than normal. The third example is the more typical, a man who heard two at the softest level and missed three. He would be classified as hearing 6 db worse than normal.

Guessing, although it never has been a serious factor in tests of this sort, is controlled by subtracting the number of excess marks from the number of correct responses.

The advantage of this type of design is that the people taking the test must be alert and quiet throughout the series of 10 items since each item may be important in determining the final score. Outside noises are also less damaging to the test since it is unlikely that discontinuous noises will mask out all five of the softest levels.

Experimental Comparison Among Tests

A test based on these principles was recorded on a phonograph disc. It tested for hearing losses at the frequencies 500, 1000, 2000, 4000, and 8000 cps and was tried out on 200 college students under the following conditions: A phonograph playback system with appropriate amplifiers was set up to drive four speakers in a large reverberant room. The new warble tone test and the older pure tone test were given binaurally to groups as large as 80 people. As a control, 36 pairs of headsets were set up in a separate room and the recorded warble

tone test as well as the pure tone test described by Myers *et al* (*5*) were given. The 72 earphones were calibrated for matched response by measuring the sound pressure delivered to a 6 cc coupler at 4000 and 8000 cps. Previous tests on the PDR-8 type phones had shown that of all the test frequencies, these two were most subject to variation. None of the phones deviated by more than ±4 db from the mean response at either frequency. The standard deviation was 1.7 db at 4000 cps and 1.9 db at 8000 cps. Two trials of each type of test were given in order to arrive at test-retest reliability measures. Certain people took both the headset and the speaker tests. Part of the group were given individual audiometer tests a few weeks later. The volume of the room used for the speaker tests was approximately 55,000 cubic feet. The reverberation time is estimated as approximately two seconds under the conditions of the test. Ambient noise in the room was reasonably low, running approximately 45 to 50 db in over-all level on the average as measured on the C or flat scale of a Scott model 410A sound level meter.

Between the test and the retest in both the speaker room and the headset room, half of the sample were moved to other positions and/or headsets while half of the sample did not move. Counting both tests and retests, a sample of over 200 young people took each type of test. The distribution of scores on each frequency and for each type of test was plotted. The median value of each distribution was defined as zero hearing loss for that frequency and for that test.[2]

[2]Sound level measurements were made for the speaker tests and coupler measurements for the headset tests. Enough information is available so that the headset levels could have been pre-set to read directly in 'hearing loss' values. Similar data is not available on a large population for loudspeaker levels. In fact it is well known that minimum audible pressure values (headsets) and minimum audible field values (loudspeakers) do not agree as to the sound pressure level necessary to elicit a threshold value. Even though fairly well grounded corrections could have been made to pre-set the loudspeaker gain so as to read in 'hearing loss' values, it was considered to be equally valid to use the subjective calibration method since the size and age of the population tested lent itself so well to this procedure. The median was used instead of the mode because one of the tests used interpolated values resulting in values only 2 db apart in certain cases the mode was not well defined.

Test Reliability

Figure 1 indicates the degree of reliability that exists between the first and second administration of the warble tone test. The ordinate shows the hearing loss value on retest while the abscissa shows the hearing loss on the test (or first administration). The data on the left represents the test-retest scatter of the warble tone test on 4000 cps when given over loudspeakers to large groups. On the right is the same information for the headset administration. A person getting the same score on both test and retest would be represented by a dot on the diagonal line. Anyone who differs by 10 db or less between test and retest is represented by a dot between the two dotted lines parallel to the diagonal line. The correlation coefficient of each set of data is shown to be around 0.90. In general this coefficient is not a good statistic to use since it is so highly dependent on extreme values of hearing loss.

A statistic is needed which is independent of the spread of the ability being measured. We want to know in

general how many of the people show no difference between test and retest, how many show differences less than ± 5 db, etc. In Figure 1, for example, only five people out of 116 differ by more than 10 db between test and retest.

We are interested in the distribution of differences between test scores and retest scores, and are not interested for reliability purposes in the actual amount of measured hearing loss. The mean of this difference distribution tells how much improvement, either positive or negative, is shown in the retest scores over the test scores by the group as a whole. This gives a measure of the constant error that affects every one and is of no particular consequence here.[3]

[3]Statistical analysis of these means as a function of the type of test, the frequency, and whether or not the person changed positions or headsets between test and retest show significant differences only among tests. The pure tone test given over loudspeakers showed divergences as large as ± 2.5 db (on 500 cps) but no other test and/or frequency combination showed differences greater than 2 db. The average difference from zero (i.e., neglecting the sign of divergence) was less one db.

The statistic that shows the individual variability is the standard deviation of the difference distribution.[4] This is the statistic used in Figure 2, which is a summary of the test-retest reliabilities of the various tests under the various experimental conditions. These data show that the reliability is worse or that the variability is measurably greater for the group who changed positions, labelled 'different,' than for those who did not, labelled

[4]Certain other investigators have used the mean deviation which combines into one measure the mean of the difference distribution and the deviation around the mean.

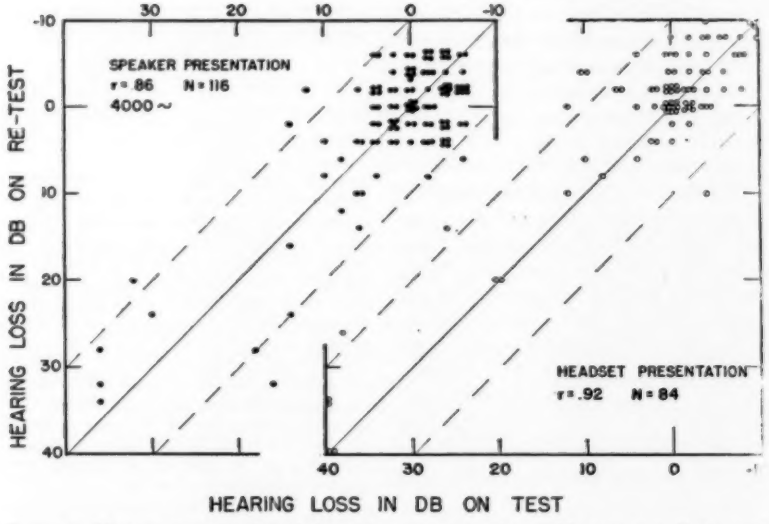

FIGURE 1. Test-retest scatterplot of the 4000 cps tone on the warble tone test. If the same amount of hearing loss was measured on both test and retest the datum point would lie on the diagonal 45° line. If the difference between test and retest was 10 db or less the datum point would lie within the two dotted boundary lines around the diagonal.

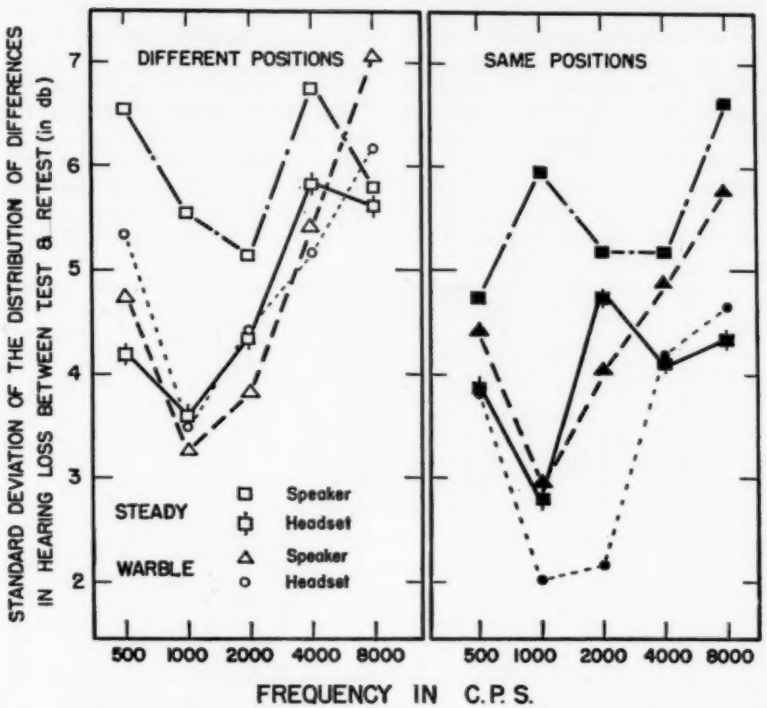

FIGURE 2. The test-restest reliability shown as the standard deviation around the diagonal line of Figure 1. These reliabilities are broken down into (1) the five frequencies used, (2) whether or not the person changed positions or headsets between test and retest, and (3) which of the four group tests the person took. See text for further details.

'same.' The variability is decidedly greater on certain frequencies than others. In decreasing order of variabilities the frequencies are 8000, 4000, 500, 2000, and 1000 cps. (Five hundred cps was always the first tone to be tested in every test.) The variability among the different types of tests is significant at the one per cent level. The steady tone test given over speakers, the squares in Figure 2, is significantly different from the remaining three which are statistically homogeneous. It is interesting to note that the increase in variability for the people who changed positions between test and retest as compared to those who did not is the same regardless of whether they listened over speakers or over headsets.

Group Tests vs Individual Audiometer Tests

The second part of this study involved comparing the results obtained by these group tests with those obtained on an individual clinical audiometer test. Figure 3 and 4 give an indication of these results on the lim-

ited number of people who returned for the individual tests. These figures are both scattergrams and tetrachoric tables. The scatter, or deviation around the diagonal line is quite large. For example, when the results of the warble tone (WT) test given over headsets is compared to the better ear results of the clinical audiometer test it is seen (Figure 3) that seven of the 31 people (23%) differ by more than 10 db. Similarly when the results of the 'Myers' test (ST) over headsets are compared to the clinical audiometer results, 6 people (19%) differ by more than 10 db.

If it is taken into account that these group tests are at best only screening tests and certain pass-fail criteria are set up, the tetrachoric aspect of these

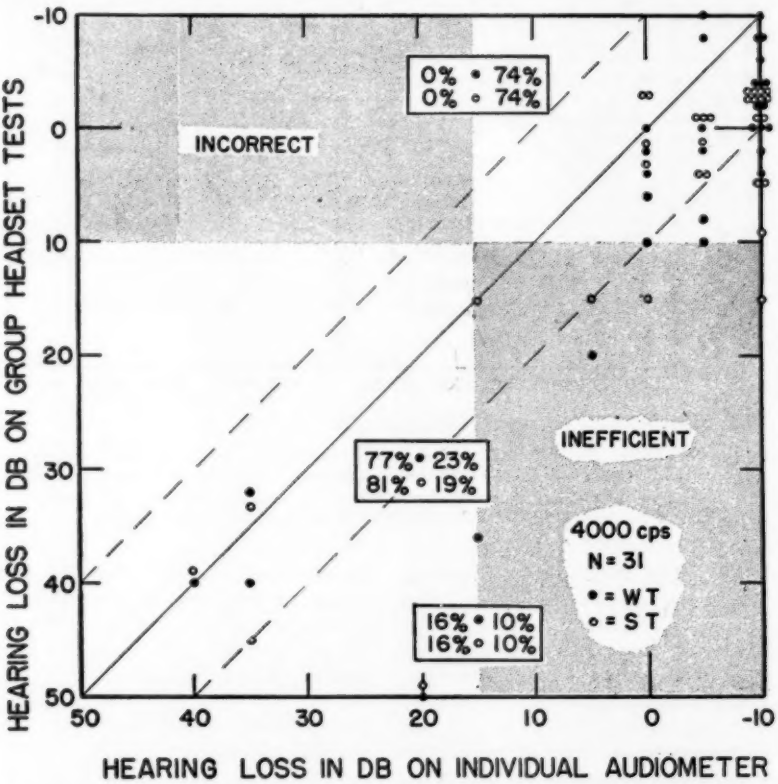

FIGURE 3. Hearing loss scatterplot on 4000 cps between the group tests and the individual clinical audiometer test. The hearing losses as measured by the recorded warble tone test (WT) and the 'Myers' test (ST) given binaurally over headsets are plotted vs the hearing loss in the better ear as determined by a clinical audiometer. Datum points on or within the dotted boundary lines show deviations of 10 db or less. The percentage of such points is shown to be 77% for the warble tone test and 81% for the 'Myers' or sine wave test. See text for explanation of quadrants and associated percentages.

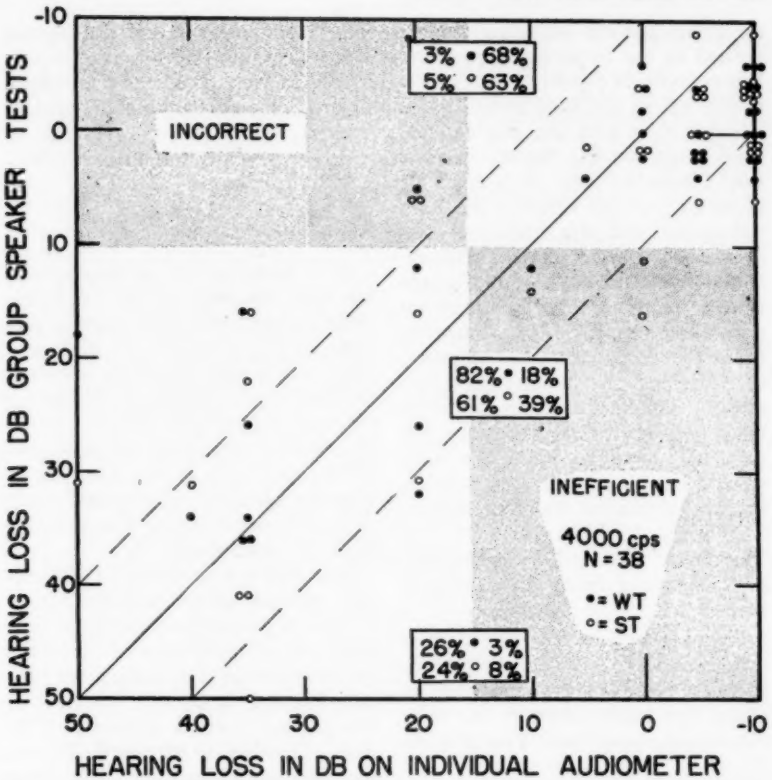

FIGURE 4. Hearing loss scatterplot on 4000 cps between the group tests, as given over loudspeakers, and the individual clinical audiometer test. The hearing losses as measured by the warble tone (WT) test, and a sine wave test (ST) played from phonograph discs over loudspeakers to large groups listening binaurally versus the hearing loss in the better ear as measured monaurally by a clinical audiometer. See legend of Figure 3 and/or text for further details.

figures becomes apparent. If a loss of 15 db or greater on the individual test be called failing while a loss of 10 db or greater on the group test be considered failing,[5] then the plot can be divided into four parts or quadrants. Those people who passed both

[5]Any noise would tend to raise the threshold of the group as a whole. The median hearing loss score of a 'normal' group in a sound proofed room should be zero. The median score of the same group under less favorable conditions would be expected to be greater than zero. That is, a more intense sound would be required to be audible. In these group tests, however, the median score was arbitrarily defined as zero. Since it must be assumed that some noise was present, it must be taken into account that the defined zero may in reality represent a 5 db hearing loss. To be conservative in such a way that no one with a 'true' loss (as measured on an individual audiometer) pass the screen, it is well to choose the screen score at a value less than the 'true' criterion.

the group and the individual test are located in the upper-right quadrant. For example, in Figure 3, 74% of the people are so classified regardless of whether they took the warble tone headset test or the 'Myers' headset test. Similarly, 16% of the people failed to pass the criterion on both the group and the individual test (lower-left quadrant). Therefore, 16% + 74% or 90% of the people were correctly screened by the group test. Three people or 10%, however, failed the group test and yet passed the individual test, lower-right quadrant. In an actual screening situation where all those failing the group test (screen) would be given the individual test these cases who actually have no significant loss represent an inefficiency. In Figure 3, no one is 'incorrectly' classified, i.e., passed the group test yet failed the individual test.

Figure 4 can be interpreted in a similar manner to Figure 3. It compares the results of the group tests as given over loudspeakers to the individual audiometer test. The data on Figure 4 shows that the warble tone (WT) test given over loudspeakers compares quite favorably with either of the group headset tests.

Newby (6) has discussed this type of tetrachoric representation but has set up criteria involving more than one frequency. For example, a loss equal to or greater than 20 db on any two frequencies or equal to or greater than 30 db on any single frequency might be considered as the dividing point between pass and fail. Applications of Newby's criteria to these data show that any of these four group tests will satisfy his tolerance limits and therefore would be considered suitable for screening purposes. The details of this are not shown since the sample size does not warrant it, and in fact, all of the conclusions in this section must be considered as indicative only. They are not based on a large enough sample to be statistically conclusive.

Summary

A pulsed-tone group hearing test has been developed which (1) uses warble tones (tones that vary in frequency at a given rate [5 cps], and vary over a given extent as from 885 to 1125 cps); (2) uses within-group attenuation (each pulse within a group of pulses is softer than the pulse preceding it); (3) is recorded on a phonograph disc (or magnetic tape) and therefore requires a less skilled operator to administer it.

This test was tried out on 200 college students under two conditions: (1) It was played back over a multiple array of loudspeakers in a reverberant room to groups of as many as 80 people, listening binaurally; (2) it was played back over a network of 36 pairs of headsets to as many as 36 people listening binaurally. These same students also were given the more usual type of group tests over both loudspeakers and headsets. The test-retest reliability was a function of frequency and whether or not the person changed positions or headsets between test and retest, but in general the new test was as reliable as the better of the two control tests whether heard over headsets or loudspeakers.

The comparison of the results of this test with the results of an individual clinical audiometer test, although based on a small sample, indicate that as a screening device it is satisfactory.

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A Cinefluorographic Technique For The Study Of Velopharyngeal Closure

James Carrell

THE MECHANISM of velopharyngeal closure is of great interest to both the speech therapist and the surgeon who must deal with cleft palate, and to others who are concerned with this function in speech and in various physiological processes. Historically, velopharyngeal action has been studied in a number of ways, including hypothesizing based on anatomical relationships, conventional roentgenography, and direct inspection and photography of the soft palate through post-surgical facial openings. Techniques of experimental phonetics also have been used.[1]

Despite the fairly extensive literature with its many important contributions, it has hitherto been impossible to describe velopharyngeal or other speech movements in a completely satisfactory way. What has been lacking is the observation and analysis of the function, as a movement, under essentially normal conditions of phonation, articulation or deglutition. The difficulties are obvious, since the action takes place within the mouth, which is closed – or nearly so – when the function occurs. One is, of course, reasonably safe in assuming that lingual and palatal function are known, at least in broad outline. Nevertheless, a full understanding will never be possible until the actual movements are seen and analyzed.

As a result of technical developments in X-ray equipment and procedures, it is now possible to report the successful application of cinefluorographic techniques to the study of normal and abnormal speech function. This has led to moving X-ray pictures which provide a very satisfactory view of the movements of the soft palate, posterior pharyngeal wall and other structures. The advantages of such a method of study over those formerly used are evident, since it permits an inspection and detailed analysis of actual function, with the possibility of artifact kept at a minimum.

The present article contains a description of cinefluorographic equipment currently in use at the University of Washington for the study of velopharyngeal movements in normal

[1] In addition to the specific references cited in this article, others of importance in this field are listed under References.

James Carrell (Ph.D., Northwestern, 1936) is Professor of Speech and Director of the Speech and Hearing Clinic, University of Washington. This article is adapted from a paper presented at the 1951 Convention of ASHA, Chicago, Ill. Apparatus used was made available by the Department of Physiology and Biophysics, School of Medicine; certain of the equipment was originally provided by the General Electric X-ray Corporation. Technical assistance and advice was given by Dr. Robert Rushmer and John A. Hendron, Department of Physiology and Biophysics, and Dr. Alton Moore, Department of Orthodontia, School of Dentistry.

and postoperative cleft palates. Forthcoming publications are planned to report research studies either completed or at present in progress.

The concept of cinefluorography is not new, actually dating back to MacIntyre, who in 1897 serialized roentgenograms in such a way as to simulate the action of a frog's hind leg. With subsequent improvement in apparatus and film for both roentgenology and motion picture photography it has become possible to take successful pictures of moving images on a fluoroscopic screen. The early work of Reynolds (*30*) has been followed by a number of reports describing satisfactory cinefluorography (*2, 5, 7, 15, 19, 21, 26, 28, 29, 30, 31, 35, 36, 38* and others). Actually, however, the technical advances in roentgenology and motion picture photography which have permitted anything approaching routine use of this technique are of relatively recent origin.

So far as can be discovered from a search of the literature on cinefluorography, there are no published reports on velar action in postoperative cleft palate individuals, and only limited or indirect references to velar function during articulation or phonation in normal subjects. Dijian (*8*) notes an effort by Fouques to analyze the processes of phonation and articulation of French speech sounds by cinefluorography, while a more complete study of a similar nature has been made by Marchal (*25*). Ramsey (*28*) was concerned in part with swallowing movements, while other cinefluorographic studies relate to respiration (*13*), coughing (*14*), heart action and circulation of the blood (*20, 22, 32, 34*) and gastro-intestinal disorders (*26*).

The technical difficulties of adequate cinefluorography are numerous. Among the earlier problems was the development of photographic equipment with sufficiently fast lens and film sensitive enough for the relatively low illumination of the fluoroscopic screen. A corollary difficulty lay in the development of fluoroscopic screens which would provide images of satisfactory intensity. Limitations also were imposed by the capacity of the X-ray tubes then available. On the matter of technique, it is necessary to take cognizance of the amount of radiation to which a patient or subject can safely be exposed, a consideration which is one factor limiting the duration of motion picture sequences.

The general instrumentation, including certain technical improvements, has been described in detail by Rushmer, Bark and Hendron (*33*), who are responsible for its design. It has been employed extensively by Rushmer for studies of heart action and has also been modified for cinefluorography of the head and neck.

Basic X-ray equipment consists of a General Electric KX-1 X-ray machine with CRT 1-2 tube. Motion pictures of the fluoroscopic images are taken with a DeVry 35 mm. camera equipped with an *f* 0.8 coated 50 mm. lens. Eastman Ortho-Graphic film was used, the combination of sensitive film and extremely fast lens thus providing satisfactory conditions for photography. In taking pictures of the head and neck the equipment is set up in such a way that the X-rays travel horizontally to fall on a Patterson E-2 fluorescent screen, which has the property of relatively short image-persistence.

An essential improvement has been provision for minimal exposure of subjects to radiation. This was accomplished by interrupting the flow of current to the X-ray generator during the time required to advance the mo-

tion picture film. Since the shutter of a motion picture camera is closed approximately half the time, this procedure reduced by 50 per cent the amount of radiation exposure. Actually, Rushmer found it possible to remove the camera shutter entirely without impairing photographic results.

The timing mechanism is described in detail elsewhere (*33*), but in general consists of a synchronous motor mounted in such a way as to drive both the film advancing mechanism of the camera and a commutator. The latter is adjusted to close a circuit during the period when the shutter normally would be open. This circuit activates a heavy-duty electronic switch which controls the flow of current to the X-ray generator. Through this arrangement each frame of the motion picture film is exposed to the light generated by four pulses of X-ray, the current then being interrupted for four pulses as the film is advanced. Since full wave rectified X-ray machines produce 120 pulses per second, pictures can thus conveniently be taken at 15 frames per second. This speed introduces a slight timing error if films subsequently are projected at the usual rate of 16 frames per second. Film speeds could, of course, be varied by appropriate changes in the gear ratio of the drive mechanism.

A second expedient used to reduce the exposure of subjects to radiation was a lead screen containing an aperture of variable size, which was fixed to the casing of the X-ray tube. This arrangement makes it possible to limit the roentgen rays to the area being photographed. It is calculated that under the conditions existing for the studies of velar action the X-ray dosage of any subject for a single sequence did not exceed 18 r over the photographic period of six seconds,[2] an amount which is well within the limits of safety.

In adapting the basic design of Rushmer to photography of the head and neck the camera and synchronous drive mechanism were mounted at one end of a light-tight box 26 inches in length, with an 8 by 10 inch fluorescent screen forming the opposite end of the box. The fluorescent screen faced the X-ray tube, of course, and the subject's head was placed in appropriate position in front of the screen. The X-rays thus passed horizontally from the X-ray tube through the subject's head to the fluorescent screen. As this occurred, the motion pictures were taken. Sequences of action were limited to six seconds. A conventional type of head positioner, attached to a base above the fluorescent screen, prevented head movement during photography. Distance of the subject from the X-ray tube was 40 inches.

At the present time clinical and research use of the cinefluorographic equipment has been too limited to realize fully its potentialities. They appear somewhat exciting, however. Verbal description of the motion picture sequences is unsatisfactory, of course, and the films do not lend themselves to the usual processes of

[2]The abbreviation 'r' designates the unit of quantity of roentgen rays and is the accepted unit employed for this purpose. What constitutes a 'safe' amount of radiation is difficult to state because of the variables involved. The amount of radiation sustained by subjects in the technique described here, however, is approximately equal to that which would occur in routine clinical fluoroscopy of 60 seconds duration. Strict medical supervision is mandatory, of course, but 20 r is considered normally to be within very conservative limits of safety.

reproduction for journal publication.[3]

It can be conservatively stated, however, that cinefluorography is entirely practical for both clinical and research purposes in the area of speech function. The views of the soft palate and other structures are astonishingly clear in properly exposed cinefluorographic sequences. Bony structures are, of course, recorded without difficulty. Definition of the posterior wall of the pharynx is somewhat less sharp than is the case with the tongue or soft palate, but is still quite good. The loss of clarity in the posterior pharyngeal wall results from the relatively great thickness of the lateral walls of the neck. Those portions of the tongue which at any time lie behind the teeth or alveolar process cannot readily be traced, of course. Lip movement can be observed.

One of the most noteworthy characteristics of cinefluorographic views is the increased visibility which comes from movement. Persons familiar with ordinary X-ray pictures of the head know that even under optimum conditions much detail is lost. During movement, however, even relatively faint shadows become quite readily perceptible and can be followed with ease. The extent to which this occurs can hardly be appreciated by one who has not seen cinefluorographic sequences of moving tissue. Comments of the same nature have previously been made by Rushmer concerning heart action. It is scarcely necessary to point out that the description of normal and abnormal speech movements may be considerably enhanced through clear visualization of ongoing adjustments of the articulators. Interest in current studies has been focussed on cleft palate problems, but a wide variety of other research applications immediately suggest themselves.

The possible clinical applications may well ultimately include cinefluorography as a routine diagnostic aid in determining the status of velopharyngeal function, evaluation of the results of variations in surgical techniques, aiding in decisions on such matters as retropositioning of the soft palate and various others. For convenient clinical use, of course, additional provision must be made for developing and projecting film, but this is practical and relatively inexpensive. Admittedly the very substantial cost of cinefluorographic instrumentation and the specialized personnel required for its operation may impose a limit on clinical applications.

[3]A 16 mm. film showing cinefluorographic views of normal soft palates and postoperative cleft palate cases is available for limited circulation. Inquiries should be addressed to the Instructional Materials Center, University of Washington, Seattle, Wash.

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Book Reviews

PARKER, WILLIAM R. *Pathology of Speech.* New York: Prentice-Hall, Inc., 1951. Pp. 321. $2.60.

The author brings to the writing of this book a great enthusiasm and a missionary spirit. He also is willing to venture into relatively new fields and includes a chapter on bulbar palsy, a subject that is largely ignored by other texts. Unfortunately, Mr. Parker's knowledge of the material that he tries to cover is entirely inadequate to his task. The result is a book that is confused and unsatisfactory.

A foreword announces that the book is 'a reliable source of information,' but it must be pointed out that actually there are many serious errors of fact throughout the book. We see, for example, 'as metabolism goes down, pitch goes up' (p. 30); 'the primary purpose of braces is to stretch the spastic muscles' (p. 86). The medical terminology is generally inaccurate. The cricoid cartilage is referred to as a 'muscle' (p. 33); aphasia is described as a 'functional disorder' (p. 144).

Probably the least objectionable section of the book is that describing stuttering in young children. This is a reasonably adequate statement of a point of view, a psychoanalytic interpretation coupled with an ultra-permissive theory of child rearing. One may well question, however, whether any stutterer is really safe in the hands of a person who refers to a stuttering interruption as 'the incorrect speech sound or speech error' (p. 248).

Despite the book's title, relatively little space is given to the discussion of pathological or other scientific bases of speech disorders, and relatively much is given to detailed descriptions of clinical procedure. Here again the author seems confused. On pages 181 and 194 he seems unable to distinguish between [s] and [ʃ].

The publisher has contributed a shoddy job of editing. The book contains repeated misspellings of syphilis, malocclusion, and other terms. The author is permitted to refer to Flourens' (1794-1867) experiments in neurophysiology as occurring in the 'twelfth century' (p. 142). From the context it is obvious that these and other telltale mistakes occurred in the manuscript rather than as typographical errors. Even though good editing would have removed them, it is clear that no amount of editorial work could have made a good book of Mr. Parker's manuscript.

It is difficult to think of circumstances under which one would want to recommend this book.

SPENCER F. BROWN.
University of Minnesota

BACKUS, OLLIE AND BEASLEY, JANE. *Speech Therapy with Children.* New York: Houghton Mifflin Co., 1951. Pp. 441. $3.00.

Expressing strong criticism of what might be termed the classical approach to speech therapy with children, the authors of this book present a theory of training based on certain principles of psychotherapy. The result is a thought-provoking discussion which represents a really fresh contribution to clinical procedures in speech.

The basic thesis is that speech therapy should be arranged to provide a situation through which the speech defective child, by a process of growth, changes his total communicative behavior and attitudes in such a way as to function with 'greater relative adequacy in terms of satisfaction and security.' Phonetic drill, tongue and lip exercises, and other forms of 'working on speech sounds' are definitely subordinated (if not completely abandoned in some

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Book Reviews is edited by Kenneth Scott Wood, University of Oregon. The section aims to inform readers of all new publications which are related directly or indirectly to the science of communication. Publications which are of more direct interest are treated with evaluative comments over the name of the reviewer; others are briefly abstracted or annotated by the *Book Reviews* editor. All new books of interest are listed under *Current Publications* whether or not they are reviewed or abstracted. Some entries here are quoted by permission from *Publishers' Weekly*.

cases) as only one isolated aspect of a speech therapy process.

The specific implications of such a viewpoint, as summarized by the authors, are: (1) Group instruction should form the core of speech therapy; (2) group membership should be non-segregated in respect to kinds of speech symptoms; (3) the teaching situation should be structured to provide corrective 'emotional' experience; and (4) the teaching situation should be structured in terms of those interpersonal relationships which involve conversational speech (p. 5).

The book is divided into two sections. The first 72 pages are devoted to an explanation of the theoretical basis for the authors' procedures. The second extensive section consists of illustrative lessons for group therapy. Lessons for preschool children are included, as are suggestions for adapting group lessons to individual work. The lessons are presented as verbatim transcripts of therapist-child responses, with appropriate notes of comment on what the therapist is seeking to accomplish and the interpretation which may be placed on the child's response. The role of phonetic instruction in the lesson is made clear, although the authors do not discuss the details involved in teaching the sounds.

It is quite impossible to give an adequate account of the psychodynamics of speech, which the authors use as the basis for their therapy, in a review of this type. Some of the basic assumptions are drawn from Lewin's vector psychology, while the concept of a growth therapy reflects in part the influence of Rogers and other proponents of non-directive techniques. Backus and Beasley acknowledge also the influence of a number of other writers in psychology and psychotherapy. In the text, however, the theoretical assumptions are drawn together and systematically presented.

There is no doubt, in the opinion of the reviewer, that Backus and Beasley have made a significant contribution to thinking about speech therapy with children, and that this book will have a wide and constructive influence. As the authors state, their present ideas doubtless will need reformulation on the basis of future clinical experience and research. The emphasis on the psychotherapeutic aspects of the speech training situation must be regarded as important.

On the other hand, many readers may feel that the authors are as extreme in their position as are those therapists who depend primarily on 'devices' and that ultimately the best therapeutic practices will lie at some midpoint. Certainly some of the apparent differences between traditional methods of speech correction and the psychotherapeutic principles of Backus and Beasley are purely verbal. For example, the process of socializing a child, which long has been regarded as necessary to the speech correction process, is essentially the same as changing behavior in 'interpersonal relationships to the extent that he can function in such relationships with greater relative adequacy in terms of satisfaction and security.' Likewise, all competent therapists, of course, take cognizance of emotional factors which interfere with communication and view the child as a 'whole.' One suspects that the inexperienced therapist attempting to follow the psychotherapeutic approach might err in the direction of too little direct instruction on the speech response.

The writing of this book has been described elsewhere as possessing 'remarkable clarity and charm.' The present reviewer regrets he cannot share this opinion. Much of the terminology, borrowed from certain schools of psychotherapy, seems to him a somewhat tiresome form of verbal shorthand which is poorly adapted to the discussion of speech therapy. This criticism is not intended to apply to the illustrative lessons.

JAMES CARRELL.
University of Washington

SCOTT, LOUISE B. AND THOMPSON, J. J. *Talking Time: For Speech Correction and Improvement.* St. Louis: Webster Publishing Co., 1951. Pp. 245. $2.40.

The author's purpose, to provide a 'simple, non-technical' book for the use of classroom teachers in a speech improvement program, has been achieved. In addition, the book contains unusually delightful games, poems, and stories which should prove valuable for any primary grade teacher.

A brief outline of a speech survey method, and instructions for making the game equipment, precede the sections of materials on consonant sounds. At the end of the book a brief chapter on phonetic symbols is included and followed by indices of materials for integrated use in classroom units. Since the section on the approach to a speech improvement program is so brief, the authors might well have included references to other sources where

the teacher could supplement this information. Except for a footnote on hearing acuity, little mention is made of the importance of hearing for articulation.

The thoroughly charming and practical material, some of which is reprinted from other books, but most of which is original, justifies the purchase of this book for classroom use.

KATHERINE F. THORNE.
University of Buffalo

KEYES, KENNETH S., JR. *How to Develop Your Thinking Ability*. New York: McGraw-Hill Book Co., 1950. Pp. 246. $3.50.

Students of general semantics who have devoted several weeks to Korzybski's *Science and Sanity* will be surprised to find that they have read Keyes' exposition of essentially the same subject in less than an hour. *How to Develop Your Thinking Ability* is a premeditated simplification of general semantics. Some clinicians may find this book a valuable aid in counseling individuals who are not likely to be affronted by its painstaking simplicity and somewhat carnival appearance. Sentences and paragraphs are short; the style is colloquial and amusing; and the vocabulary is basic. There is much repetition and summarization, and salient comments are frequently set in large capitals. Whimsical, sometimes mildly racy, illustrative cartoons occupy one-third the total number of pages.

The text develops six 'tools for thinking.' The phrase, 'so far as I know,' when used with sufficient consciousness of its implication that reality is too complex for anyone to generalize about it with certainty, helps to develop openmindedness and the habit of suspending judgment. 'Up to a point' is language appropriate to a world in which most things exist in any number of possible degrees and are not described adequately in 'either-or' terms. 'To me' implies awareness that judgments are based on personal perceptions which vary from individual to individual in a manner conducive to rationalizations and unnecessary disagreements. The 'what,' 'when,' and 'where' indexes serve as warnings that the particulars categorized by a word may differ, change, and vary under varying conditions in important ways. Separate chapters discuss the application of these 'tools' in 'getting along with people,' marriage, business, causation and social progress.

The emphasis is placed throughout on these clearly defined implications of Korzybski's work for language behavior. There is correspondingly less discussion of some of the considerations of language and our surroundings from which they are derived. For example, the process of abstracting, in a sense basic to general semantics, is represented in Keyes' book only by frequent references to the familiar map-territory analogy. With the abstracting process reduced, in effect, to two levels, the development of its interesting and significant implications is necessarily somewhat coarse. Nevertheless, the essence of Korzybski's formulations is retained to a surprising degree, considering that the reader unquestionably travels light. That the author is able to select and organize as effectively as he does testifies to an excellent command of the subject as a whole. It is gratifying, also, that his solicitude for the reader's comfort does not prevent him from cautioning repeatedly that the effective use of any 'tools for thinking' has limitations, requires effort and judgment, and, in general, is not a simple matter.

OLIVER BLOODSTEIN.
Brooklyn College

RONNEI, ELEANOR C. *Learning to Look and Listen*. New York: Teachers College, Columbia University, 1951. Pp. 180. $3.50.

The primary purpose of this book is to serve as a manual for teachers in training a child to wear a hearing aid effectively and happily. Not until he does this will he place a high value on listening. The author, through her many years of close association with hard of hearing children and adults, has a deep insight into their specific hearing problems. As a successful teacher she has been able to break these problems down into their basic elements. Her book is more than a teachers' manual, however; it is an analysis of the listening habits of all, even those with normal hearing. Every teacher of speech and every primary teacher will profit from reading the *Suggestions for the Use of the Text*, and studying the aims and developmental procedures in the lesson plans.

After outlining the training of the child for an awareness of the sounds about him, those that things, animals, and people make, the lesson plans develop in a well ordered manner three related aims: (1) Planned and directed listening to music gives aesthetic

pleasures that children enjoy. In carefully graded lessons the author shows what fun can be had in listening for differences in volume, pitch, tempo, rhythm, and tone quality. The experiences she suggests in recognizing musical instruments by their sound, and men, women, and children by their voices, give the child a feeling of achievement and normalcy. (2) The lessons on actual speech sound discrimination are planned to give the child success. From both her empirical and scientific knowledge, Mrs. Ronnei has determined the order of taking up the phonemes with this in mind. (3) Right from the beginning, each lesson includes interesting devices for training the child in distance hearing.

The author uses excellent educational psychology in her approach. She works from the synthetic to the analytic, making every experience meaningful, which is, of course, essential in working with the hard of hearing child. It gives him the assistance of all possible cues. Provision is made for the use of every related sensory stimulus, so that through association the weakest sense will start to function before it is isolated for development. Mrs. Ronnei starts with experiences familiar to the child, but is specific in her suggestions for extension of these experiences to lead into new and more complicated listening situations. At the same time she makes them interesting, challenging, and stimulating to growth in other educational areas. She understands the psychology of childhood, and provides opportunity for bodily activity, manipulation, use of the imagination and dramatization, and interesting experiences, all of which aid in the learning process.

The therapist will be grateful to find between the covers of a single book such a wealth of suitable material selected from the best literature for children. Standard texts for stimulating language and reading readiness are recommended, and actual page references are frequently given. Successful experience with these books will enable the hard of hearing child to adjust more easily to a normal classroom situation. Certain commercial phonograph records have been recommended, and suggestions are given for tape recordings of sounds of everyday life at home, in the city, or on the farm. While the books and commercial recordings are listed for each lesson, a compiled list at the end of the manual would be useful and time-saving.

The author does not offer these lesson plans to be followed exactly or completely by any teacher, but rather as helps in organization, methods, and materials. The book will be of value not only to teachers of children learning to use a hearing aid, but also to teachers of speech correction, especially for delayed speech and organic speech disorders. It should be helpful to classroom teachers of primary grades, for they, too, need specific helps in training children to 'look and listen.' The author has made an important contribution to the field of speech and hearing education.

ELVENA MILLER.
Seattle Public Schools

WILSON, CARMEN, comp. *Magnetic Recording: 1900-1949, Bibliography.* Chicago: The John Crerar Library, 1950. $1.00.

This mimeographed and paper-bound bibliography has attempted to be 'complete for published literature through the year 1949, tracing the history, growth, and present applications of magnetic recordings and to include outstanding patents.' This has been done chronologically from the year 1900. Each of the 339 entries is numbered, and contains a short descriptive abstract.

The bibliography is indexed by subject and by personal or corporate names.

For the person interested in magnetic recording research, this bibliography (it replaces the publisher's Reference List series) should prove to be extremely valuable.

NORMAN W. FREESTONE.
Occidental College

SLAVSON, S. R. *Analytic Group Psychotherapy with Children, Adolescents and Adults.* New York: Columbia University Press, 1950. Pp. 275. $3.75.

This book reports the fruits of its author's 15 years of experience in the Jewish Board of Guardians in New York. In its more theoretical aspects, the volume deals with the psychoanalytic conception of the dynamics of psychotherapy generally and discusses such processes as target multiplicity, cathexis displacement, and universalization, which are presumed to be specific to the group therapy situation. In its more practical sections, it deals with criteria for selecting and grouping patients and for utilizing the various forms of activity or interview group psychotherapy that Slavson has developed. Sections are devoted to the conduct of group psychotherapy with preschool and school age children, with adolescents and with adults, and to the special problems of group psychotherapy

with psychotics and in correctional schools for delinquents.

EDWARD JOSEPH SHOBEN, JR.
Columbia University
Teachers College

HOLLOWAY, JOHN. *Language and Intelligence.* London: Macmillan and Co., Ltd., 1951. Pp. 192. $2.00.

This little book by an Oxford logician lucidly presents the argument that language usage cannot be considered as other than a form of behavior and is therefore not subject to a precise logical systematization. Holloway opens with a critical examination of the most prominent current theories of meaning, proceeds to a discussion of the concepts of intelligence and habit in behavior generally, and then takes up the problem of communication by both nonverbal and verbal means. The last part of the volume considers various ways of reducing vagueness and ambiguity in language and the functions of language as a behavioral tool serving many different purposes. The approach is that of the technical philosopher, but the implications for such other fields as psychology are clearly drawn.

EDWARD JOSEPH SHOBEN, JR.
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REDL, FRITZ AND WATTENBERG, WILLIAM W. *Mental Hygiene in Teaching.* (Ed. by Willard B. Spalding and Ernest R. Hilgard) New York: Harcourt, Brace and Co., 1951. Pp. 454. $3.50.

After two introductory chapters, the authors devote 133 pages to behavior mechanisms, developmental psychology, and the influence of important factors in individual development. Certain trouble-breeding situations are discussed and followed by a consideration of the concepts of maturity, adjustment, and normality. The next 149 pages are concerned with ordinary classroom problems and the relationship between mental hygiene and learning. The section entitled 'Special Problems' discusses children who need special help, the teacher's problem, working with parents, and the limitations of mental hygiene in education.

Current Publications

ANDERSON, HAROLD H. AND GLADYS L., eds. *An Introduction to Projective Techniques: And Other Devices for Understanding the Dynamics of Human Behavior.* New York: Prentice-Hall, Inc., 1951. Pp. 720. $6.75.

BARUCH, DOROTHY W. *One Little Boy.* New York: Julian Press, Inc., 1952. Pp. 242. $3.50.

BENDER, LAURETTA. *Child Psychiatric Techniques.* Springfield, Ill.: Charles C. Thomas, 1952. Pp. 360. $8.50.

BERELSON, BERNARD R. *Content Analysis in Communication Research.* Glencoe, Ill.: Free Press, 1952 (Foundations of Communication Research Series). Pp. 220. $4.00.

BERGER, KATHLEEN AND BYERS, E. E. *Dictation for the Medical Secretary.* New York: Gregg Publishing Co., 1952. Pp. 311. $3.00.

BETTS, EMMET A. *Foundations of Reading Instruction: With Emphasis on Differentiated Guidance.* New York: American Book Co., 1950. Pp. 757. $6.00.

BUHLER, FRAU C. M. AND OTHERS. *Childhood Problems and the Teacher: With a Chapter on Remedial Work by Franklyn Bradshaw.* New York: Henry Holt and Co., 1952. Pp. 383. $3.75.

CASH, JOAN F. *A Textbook of Medical Conditions for Physiotherapists.* Philadelphia: J. B. Lippincott Co., 1951. Pp. 350. $5.00.

CUTSFORTH, THOMAS D. *The Blind in School and Society: A Psychological Study.* New York: American Foundation for the Blind, 1951. Pp. 269. $2.75.

DAWSON, MILDRED A. *Teaching Language in the Grades.* New York: World Book Co., 1951. Pp. 341. $3.80.

DOLCH, EDWARD W. *Psychology and Teaching of Reading.* (2nd ed.) Champaign, Ill.: Garrard Press, 1951. Pp. 520. $3.50.

FENLASON, ANNE F. *Essentials in Interviewing: For the Interviewer Offering Professional Services.* New York: Harper and Brothers, 1952. Pp. 352. $4.00.

FISHBEIN, MORRIS AND SALMONSEN, ELLA M., eds. *A Bibliography of Infantile Paralysis: 1789-1949.* (2nd ed.) Philadelphia: J. B. Lippincott Co., 1951. Pp. 899. $16.00.

GEMELLI, AGOSTINO. *La stutturazione psicologica del linguaggio studiata mediante l'analisi elettroacustica.* (The psychological structure of language studied by means of electro-acoustic analysis) Vatican City: The Pontifical Academy of Science, 1950. (Monograph No. 8) Pp. 53.

GESELL, ARNOLD L. *Infant Development: The Embryology of Early Human Behavior*. New York: Harper and Brothers, 1952. Pp. 108. $3.50.

GREENACRE, PHYLLIS. *Trauma, Growth, and Personality*. New York: W. W. Norton and Co., 1952. Pp. 340. $4.50.

GURVITZ, MILTON S. *The Dynamics of Psychological Testing*. New York: Grune and Stratton, Inc., 1951. Pp. 396. $6.75.

HARTLEY, RUTH E. AND OTHERS. *Understanding Children's Play*. New York: Columbia University Press, 1952. Pp. 388. $3.50.

HINCKLEY, ROBERT G. AND HERMANN, LYDIA. *Group Treatment in Psychotherapy: A Report of Experience*. Minneapolis: University of Minnesota Press, 1951. Pp. 146. $3.00.

HOBBS, ALBERT H. *The Claims of Sociology: A Critique of Textbooks*. Harrisburg, Pa.: Stackpole Co., 1951. Pp. 189. $2.75.

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LLOYD, LL. S. *Music and Sound*. (2nd ed.) London: Oxford University Press, 1951. Pp. 181. $2.75.

LOEWY, HERTA. *The Retarded Child: A Guide for Parents and Teachers*. New York: Philosophical Library, 1951. Pp. 160. $3.75.

MOLONEY, JAMES C. *The Battle for Mental Health*. New York: Philosophical Library, 1952. Pp. 115. $3.50.

MONS, W. *Principles and Practice of the Rorschach Personality Test*. Philadelphia: J. B. Lippincott Co., 1951. Pp. 176. $4.00.

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SMITH, F. V. *The Explanation of Human Behavior*. New York: The Macmillan Co., 1952. Pp. 285. $2.75.

THOMPSON, GEORGE G. *Child Psychology: Growth Trends in Psychological Adjustment*. Boston: Houghton Mifflin Co., 1952. Pp. 700. $5.50.

VAIL, DERRICK AND LINDSAY, JOHN R. *1951 Year Book of Eye, Ear, Nose, and Throat*. Chicago: Year Book Publishers, 1952. Pp. 456. $5.50.

WALKER, JANE. *Jane Walker's Book of Art Lectures for Lipreading Practice*. (Mimeographed) Washington, D. C.: The Volta Bureau, 1951. Pp. 61. $3.12.

WEATHERHEAD, LESLIE D. *Psychology, Religion and Healing*. Nashville: Abingdon-Cokesbury Press, 1951. Pp. 543. $5.00.

WECHSLER, ISRAEL S. *A Textbook of Clinical Neurology*. (7th ed.) Philadelphia: W. B. Saunders Co., 1952. Pp. 801. $9.50.

WHITEHURST, MARY W. AND MONSEES, EDNA K. *Auditory Training for the Deaf*. Washington, D. C.: The Volta Bureau, 1952. Pp. 99. $3.12.

WILLEY, ROY D. *Guidance in Elementary Education*. New York: Harper and Brothers, 1952. Pp. 838. $5.00.

Abstracts

PHILLIPS, E. L., SHENKER, S. AND REVITZ, P. The assimilation of the new child into the group. *Psychiatry*, 14, 1951, 319-325.

Four groups of three normal children each, between the ages of six and seven, were formed into nucleus social groups. A fourth child, a stranger to the group, was introduced into each group and the resulting interaction studied during six play sessions. Generalizations about the interactions are presented. (*D.C.S.*)

TOLHURST, G. The integration of professional services in treating organic disorders of speech. *Sth. Speech J.*, 17, 1951, 106-113.

The writer advocates the 'team' approach to cerebral palsy, cleft palate, and other organic disorders of speech. Members of the team should share equal professional status and should arrive at decisions through conference. (*C.G.W.*)

KESSLER, H. E. The speech of your young dental patients. *Dent. Surv.*, 27, 1951, 1093.

There is a need for dentists to have a knowledge of the development and process of speech. His advice concerning speech is continually asked for by his patients. Non-dental factors, both organic and functional, including illness, poor muscular co-ordination, enlarged adenoids and nasal obstructions, can have etiological importance. There are also relationships between certain dental conditions and poor production of speech sounds. These conditions are malocclusion, loss of teeth, shortness of soft palate, cleft palate, tongue tie and fear of showing unsightly dentition. (*G.H.S.*)

GARDNER, W. H. Rehabilitation after laryngectomy. *Pub. Hlth Nurs.*, 1951, 43, 612-615.

The anatomy of the post-laryngectomized patient and several methods of speech rehabilitation are discussed briefly. The stages of training in esophageal speech are presented. Evaluating the success of esophageal speakers, Dr. Gardner states that 70 per cent attain good or fluent speech, 16 per cent acquire fair speech and 14 per cent are unable to belch or produce a continuous series of words. He suggests an average of six lessons is needed to achieve adequate speech. There are observations of the effect of laryngectomy on occupational status. (*A.J.B.*)

APPLEMAN, R. M. The repair of an acquired cleft (or deformity) of the maxilla. *Oral Surg. oral Med. oral Path.*, 4, 1951, 1363.

A semantic difference between a cleft (congenital), and a deformity (acquired) of the maxilla is impressed, both invariably resulting in impediments of speech, mastication, insalivation and deglutition.

Prosthesis for cleft palates becomes a process of individual diagnosis and construction. Several unique methods of prosthesis are described and mentioned as having been reported by Crawford and Capon, Ruggles, Cupit and Kazanjian.

The case of a 29-year-old woman is reported. Photographic plates are presented showing 'curtain like extensions' of the soft palate, a cleft at the juncture of hard and soft palates, and construction of den-

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Abstracts is edited by Eugene T. McDonald, Pennsylvania State College, assisted by the following committee: Asa J. Berlin, Pennsylvania State College; Leo G. Doerfler, University of Pittsburgh; James V. Frick, Western Michigan College of Education; Lester L. Hale, University of Florida; Jack Matthews, University of Pittsburgh (George Shames, University of Pittsburgh, substituted for Dr. Matthews for this issue); Georgianna M. Peacher, Temple University; Sylvia O. Richardson, Children's Medical Center, Boston, Mass.; D. C. Spriestersbach, State University of Iowa; Hildred M. Schuell, Veterans Hospital, Minneapolis, Minn.; Jesse J. Villarreal, University of Texas; Charlotte G. Wells, University of Missouri. The committee systematically reviews 203 journals for articles of interest to members of ASHA. Students and other members are encouraged to submit abstracts. Directions for preparing abstracts may be obtained from the abstracts editor.

tures and prosthesis. Nasal speech had developed at age 13. Speech was described as normal after prosthetic rehabilitation. (*G.H.S.*)

KESSLER, H. E. A study of cleft palate and harelip cases in the Cleveland Public School System. *Oral Surg. oral Med. oral Path.*, 4, 1951, 1381.

Frequencies and ratios of cleft palate births are mentioned as having been reported from 1864 to 1947. In various areas of the world, these figures have ranged from one in 2,400 births to one in 638 births. This article reports all repaired and unrepaired cleft lips and palates in the Cleveland school system.

The two most common difficulties found resulting from surgery were an uneven vermillion border and a short soft palate. Photographic plates representing these surgical results are presented. It is important for surgeons to be aware of the process of speech production, so that surgery is functional in terms of speech. Disturbances of dental and facial growth by early surgery is reported. Seven etiological possibilities are put forth, but none has been conclusively established.

Statistics on 63,135 children are reported. A ratio of one in 889.2 children had harelip and/or cleft palate; 56.9% were boys; 12.7% were Negro. (*G.H.S.*)

WESTLAKE, H. A system for developing speech with cerebral palsied children: part IV. *Crippled Child*, 29(4), 1951, 18-21, 29.

A number of methods for acquiring better peristaltic action of the tongue, lips, and cheek are described. The importance of the technique of stabilization is reaffirmed in an explicit manner. Then, the author discusses the third phase of his system, direct speech training, and emphasizes the flexible nature of the system by saying the phases 'are not proposed as a routine to be followed in order, but as an organization for a broad assortment of learning situations which can be offered to the child.' (*J.V.F.*)

HATCHER, C. Recreational activities of cerebral-palsied children. *J. except. Child.*, 18(4), 1952, 102-106.

A description of various games and activities 'designed to meet the needs of children who are limited in muscular coordination, who have poor head balance, limited ambulation, and inadequate speech production.' (*J.V.F.*)

GREENWOOD, E. The psychiatrist's role in the treatment of cerebral palsy. *Crippled Child*, 29(4), 1951, 6-7, 28.

A discussion of the major problems met by the cerebral palsied child and his important environmental figures in their mutual relationship. (*J.V.F.*)

YANNET, H. AND HORTON, F. Hypotonic cerebral palsy in mental defectives. *J. Pediat.*, 9, 1952, 204-211.

The author stresses the relative importance of the hypotonic type of cerebral palsy among the mentally defective. Helpful data is included for evaluating the hypotonic. (*S.O.R.*)

DOBBS, H. Children with defects: steps forward. *Peabody J. Educ.*, 29, 1951, 157-165.

Two factors seem to provide the best chance for a child to develop himself in relation to the community: early and continued efforts in behalf of children with defects and efforts that are tied to the child's home. Ways of meeting the needs of children with defects include: recognition of individual worth, overcoming of civic indifferences, preservation of family care, maintenance of the child in regular classes, provision of extra facilities, promotion of teacher leadership, counseling with parents and the community, conferences, and research. (*C.G.W.*)

BROWN, S. F. Speech disorders in children. *Post. Grad. med. J.*, 11, 1952, 65-68.

A brief presentation of the etiology of delayed speech, articulatory defects and stuttering, written for the general practitioner and pediatrician. (*S.O.R.*)

LAYCOCK, S. Helping parents to accept their exceptional children. *J. except. Child.*, 18(5), 1952, 129-132, 160.

A discussion of the many ways in which parents of exceptional children may be helped to love and accept them. (*J.V.F.*)

IVY, A. The importance of research on the prevention of crippling diseases. *Crippled Child*, 29(4), 1951, 4-5.

Though appreciable gains have been made, a great deal of research remains to be done since one out of every five persons in this country has a chronic disease or permanent impairment and, by 1980, 80% of our population will be supporting the other 20%. (*J.V.F.*)

HUIZING, H. C. AND POLLACK, D. Effects of limited hearing on the development of speech in children under three years of age. *J. Pediat.*, 8, 1951, 53-59.

The authors stress the importance of diagnosing hearing impairment as early as possible, preferably before the child reaches the period of maximum speech development. Hearing aids are recommended from the age of two years or even earlier, and the basic requirements for aids on children are discussed. The hard of hearing children should be educated together with normal hearing children, helped by lipreading and auditory training, and provided with hearing aids whenever possible. (*S.O.R.*)

O'NEILL, J. An exploratory investigation of lipreading ability among normal hearing students. *Speech Monogr.*, 28, 1951, 309-311.

This study was undertaken to determine what psychological factors might be associated with lipreading ability of normal hearing college students. Twenty students were given one of the Mason motion picture tests of visual hearing, scores on the test being accepted as indications of lipreading ability. Tests purportedly exploring the degree of personal adjustment, perceptual abilities, reading ability, intelligence and speech attitude were given to each student. The results of these tests were correlated with the scores on the criterion test. The score on block design from the Wechsler-Bellevue Test of Adult Intelligence was the only item which was significantly correlated with the criterion test score. (*D.C.S.*)

STEVENSON, R. S. Sociological aspects of deafness. *Practitioner*, 167, 1951, 510-513.

A brief discussion of the sociological and psychological aspects of deafness and its management in the United Kingdom. (*S.O.R.*)

SILVERMAN, S. R. AND HARRISON, C. E. The National Research Council group hearing aid project. *Amer. Ann. Deaf*, 96, 1951, 420-431.

The authors report progress on the experimental use of two group hearing aids which were designed to 'reach' profoundly deaf youngsters. These units were installed at Central Institute for the Deaf and the Clarke School for the Deaf in 1948.

The report includes a technical description of the units, an evaluation of operational advantages and disadvantages, and the psychological and educational effects obtained through their use. Research is presently being conducted to determine whether the units have contributed to academic acceleration. Since the experimental units were very expensive, a simpler version is being developed at the present time. (*A.J.B.*)

TIMBERLAKE, J. Hearing aids on their fiftieth anniversary. *Volta Rev.*, 53, 1951, 507-509, 534-538.

A survey of the history and development of electrical hearing aids. The author discusses some of the problems regarding the functioning and comfort of earlier hearing aids as well as the more recent models which have succeeded in solving many of these problems. Illustrated. (*A.J.B.*)

ANSBERRY, M., moderator. A practical approach to hearing aid selections. *Hearing News*, 19(7), 1951, 3-18.

This is a question and answer presentation of the procedure for hearing aid selection used at the University of Illinois College of Medicine. A panel discussion follows the main presentation. (*A.J.B.*)

COUNCIL ON PHYSICAL MEDICINE AND REHABILITATION. Pure tone audiometers. *J. Amer. med. Ass.*, 146, 1951, 255-258.

This is a complete presentation of the latest report by the Council on minimum requirements for acceptable pure tone audiometers for diagnostic purposes. (*S.J.O.*)

Education for the child with impaired hearing. *J. nat. Educ. Ass.*, 4, 1951, 272-274.

The article consists of a picture story composed of photographs which were contributed by residential and day schools throughout the country. These photographs show the operation of mobile testing units, screening programs, community planning, group hearing aids, kinds of instruction for the deaf and medical examination. (*L.L.H.*)

FREUD, E. Clinical language rehabilitation of the veteran: methods and results. *Amer. J. Psychiat.*, 107, 1951, 881-889.

Case types and treatment are discussed, describing the first year of speech service offered at the Veteran's Mental Hygiene Clinic in Newark, N. J. (*C.R.E.*)

NEWMAN, E. The pattern of vowels and consonants in various languages. *Amer. J. Psychol.*, 64, 1951, 369-379.

Old and New Testament passages of 11 different languages were analyzed as a series of binary items with consonants given the value one and vowels given the value zero. Measures of 'autocorrelation' and 'certainty' were computed. There seemed to be systematic differences in syllable length among some of the languages and the primitive languages showed greater restriction in patterning than did English. The measure of structure changed little beyond the fifth or sixth letter. (*C.R.E.*)

BELASCO, S. Variations in color and length of French [a]: A spectrographic study. *Language*, 26, 1950, 481-488.

The relation between the duration of a vowel and its variations in color (i.e., variations in frequency of formants as shown by spectrographic analysis) is studied by measuring 445 spectrograms of the accented and unaccented French [a] by the same informant. The graphed data shows that duration associated with accent in French tends to lower the formant frequencies of an [a] sound. The average or mean frequencies for formants 1, 2, and 3 of the accented [a] variants are lower than those of the unaccented [a] formants. In physiological terms, these results indicate that duration associated with the French accent is correlated with closing of the buccal cavity (tongue-raising) and lengthening of the buccal cavity (tongue-backing). (*JJ.V.*)

MESSING, G. M. Structuralism and literary tradition. *Language*, 27, 1951, 1-12.

The point-of-view advanced by 'structuralist linguistics' (i.e., that all languages may be analyzed in the same way, regardless of the level of culture of the group in question) is criticized. It is argued that languages differ in importance according to the culture level of the language group, and that the more important languages are qualitatively more diffuse and refractory. The written form is held to be more important than is usually conceded by the structuralist. The 'cardinal doctrine of the structuralist' is that for both practical purposes and scientific analysis a language is the way people talk, not the way someone thinks they ought to talk. This doctrine is rejected. It is argued that the bearers of the literary tradition in a culture community rightfully exercise a shaping influence on 'the way people ought to talk.'

It is argued that 'structuralist linguistics' has been shaped by the assumption that the American situation in which the educated person is not expected by his community to display great proficiency in speaking and writing his native tongue is universal, and that this assumption is not true. (*J.J.V.*)

MURRAY, E. Interaction of communication blockages with personality development. *West. Speech*, 15, 1951, 54-59.

The speech-handicapped child must be helped to develop his 'whole' personality. He must be flexible if he is to see relationships, evaluate, and communicate. No one of these aspects is sufficient, but all should be developed. (*C.G.W.*)

JOHNSON, W. Being understanding and understood: or how to find a wandered horse. *Etc. Rev. gen. Semant.*, 8, 1951, 171-180.

In work with the handicapped, we need to understand them more completely, to look at things from their points of view. We should try to think as the particular handicapped person thinks, overlooking neither causes or symptoms in our diagnoses. (*C.G.W.*)

NELSON, O. An in-service program for the public school. *West. Speech*, 15, 1951, 32-35.

For effective speech training, the participation of the classroom teacher is needed. In the program described, the consultant comes to the school, interviews the children with speech problems, makes recommendations, and then demonstrates for the teachers the work that can be done in the classroom with these speech-handicapped children. (*C.G.W.*)

RESNICK, J. Group dynamics in the classroom. *J. educ. Sociol.*, 25, 1951, 112-116.

The author believes that group dynamics should be made a part of the classroom so that every individual in the group may be given an opportunity to contribute to the best of his ability toward the solution of a particular problem. An objective of group dynamics is 'to help the student do better this desirable type of activity in which he will participate.' Although the group process is often slower than the more direct approach,

the educator must bear in mind that this way of learning often is more important than the immediate goal.

The author discusses the following techniques for attaining maximum efficiency in a group: (1) Establish a goal or limit the problem under discussion to relative boundaries, (2) Subjects over which a great deal of prejudice exists in the group should not be initial part of discussion, (3) May present each member with a general outline which may serve to stimulate thought and provoke questions, (4) Reduce formality to a minimum, (5) Try to avoid controversies over the interpretation of a phrase or words, (6) Judge accomplishment in terms of improvement in working together as a group as well as in rapidity of arriving at a solution or obtaining of an idea, (7) At all times be aware of necessity of supporting position with evidence, (8) Have frequent summaries of progress made. (*L.L.H.*)

Low, G. M. and Sheets, B. V. The relation of psychometric factors to stage fright. *Speech Monogr.*, 28, 1951, 266-271.

This study investigated the relationships between stage fright and the results of various psychometric tests such as the Minnesota Multiphasic Personality Inventory, the American Council on Education Psychological Examination for College Freshmen, The Cooperative English Test, and the Lee-Thorpe Occupational Interest Inventory.

One hundred and thirty-two students from the Fundamentals of Speech course at the University of Utah were selected for study who met the criterion either of the 'most stage fright' group or of the 'least stage fright' group.

While the most significant difference between those with the most stage fright and those with the least stage fright was the amount of speaking experience in their backgrounds, both groups had approximately equal opportunities to obtain speaking experience. The lack of speaking experience was tentatively interpreted as symptomatic of a more deep-seated personality problem suggesting the need for a clinical approach to the more severe cases. (*D.C.S.*)

Lazarus, R. S., Eriksen, C. W. and Fonda, C. P. Personality dynamics and auditory perceptual recognition. *J. Personality*, 19, 1951, 471-482.

In this experiment the relationships between performance on a sentence completion test and auditory perceptual recognition of sexual, aggressive and neutral sentences were studied. The test used consisted of 48 sentences masked with white noise so that recognition was about 50 per cent accurate. Thirty-five Veterans Administration outpatients were used as subjects. The findings suggest that accuracy of perceptual recognition and clinical diagnostic data are highly related. (*D.C.S.*)

Platt, J. Speech disorders and counseling. *Occupations*, 30, 1951, 102-104.

Speech is a form of behavior and behavior is a part of personality. Therefore, the personality must be considered when we consider speech. Since normalcy is emphasized in contemporary culture, the parent often needs to help the child to take an objective attitude toward handicaps—his own and others.

The speech pathologist is interested in speech disorders only secondarily. His main interest is in helping the individual to adjust in so far as speech disorders are concerned. Counseling is of great importance in helping the individual to view his speech problem realistically and, as far as is possible, minimize its importance. (*C.G.W.*)

Hawkey, L. The use of puppets in child psychotherapy. *Brit. J. med. Psychol.*, 24, 1951, 206-214.

The role which puppets have played in the psychotherapy given to individual cases by the author is discussed. The author feels that puppets have proven particularly helpful in cases where children have difficulty in formulating and expressing their phantasies or where they have a need to express 'bad' phantasies. Three case histories are presented. (*D.C.S.*)

Post, D. P. Art therapy for speech, reading, and emotional blocks. *West. Speech*, 15(4), 1951, 49-51.

Drawing a picture and telling about it may encourage introspection in the child with a speech, reading, or emotional problem. Further, it catches the thing uppermost in his mind by calling for an immediate and subjective response, it assures him an enjoyable expressive experience, and it provides him with an opportunity to produce something that can be praised. Concrete pictures, discussed in written or oral form by the child, may give more information than answers to direct verbal questions. (*C.G.W.*)

PENFIELD, W. AND WELCH, K. The supplementary motor area of the cerebral cortex. *Arch. Neurol. Psychiat.*, 66, 1951, 289-317.

This study reviews the previous literature on electrical stimulation of the cortex and presents the results of local electrical stimulation and patterns of focal seizures due to discharge in an area designated by the authors as the supplementary motor area, which lies within the longitudinal fissure immediately anterior to the motor cortex. Responses secured from 24 human subjects and 11 monkeys are described.

In monkeys stimulation of this area revealed a motor representation of the contralateral extremities, and inhibition of spontaneous grasping. In man responses secured included vocalization, inhibition of speech, and movement complexes described as (1) assumption of postures, (2) maneuvers such as stepping, and (3) rapid incoordinated movements. The limbs of the ipselateral as well as the contralateral side of the body were affected. Papillary dilation, cardio-acceleration, bodily sensations, and in one case, arrest of breathing also occurred as a response to stimulation of this area.

Vocalization produced was characterized by periodic changes of pitch and volume, giving it a rhythmic character. Continuous vocalization with gradual elevation of pitch and reduction of volume was also secured. There were usually accompanying movements of the face and head. The responses described were obtained from stimulation of either hemisphere. (*H.M.S.*)

WALSHE, F. On the interpretation of experimental studies of cortical motor function with special reference to the 'operational view' of experimental procedures. *Brain*, 74, 1951, 249-266.

Physiological misconceptions which have arisen from uncritical acceptance of experimental results are discussed and the following sources of error pointed out: (a) failure to take into account variations in experimental procedure, (b) failure to take into account differences between subjects, (c) failure to appreciate that we see only what the experiment yields, and that procedure and result are both primary data, (d) failure to appreciate that isolation of a phenomenon for purposes of investigation involves an abstraction, and that abstractions must be safeguarded by constant reference to what is being left out.

The conception of the structural basis of the motor cortex has arisen from the fallacious assumption that the Betz cell is precisely defined, constantly identifiable, and exclusive in its role; and that the 'fixed mosaic' hypotheses of cortical function could only be constructed by regarding the cortical maps of stimulation studies as more than ways of showing diagrammatically what a certain type of study yielded; and by ignoring the observations of clinical neurologists that muscles may be paralyzed for some purposive movements and not for others. The author concludes that the brain must be regarded as a form and a series of events, and that the physiologist must think in terms of process rather than in terms of structure. (*H.M.S.*)

ETHELBERG, S. Changes in circulation through the anterior cerebral artery: a clinico-angiographical study. *Acta Psychiat., Kbh.*, Supp. 75, 1951, 1-211.

This study is based upon a systematic examination of 55 patients with a diagnosis of circulatory changes of the anterior cerebral artery confirmed by angiography. It presents case histories of these patients, an analysis of findings, and an extensive review of pertinent literature. Mental changes, disturbances of consciousness, of rapid sequential movements, speech disturbances, further motor signs, sensory and autonomic changes, and syndromes established on the basis of the present series are discussed.

Speech symptoms resembled those found in cerebellar diseases except that they were usually transient. They coincided with the onset of the disease and existed in the absense of paresis of the involved musculature. They consisted of retardation and monotony of speech, loss of volume, and inconsistent articulatory errors which the author attributed to the inability to perform extremely rapid sequential movements. The symptoms were found with lesions of either hemisphere. No aphasic systoms were found. The author attributed the speech disturbances to involvement of area 6 of Brodmann. (*H.M.S.*)

RASMUSSEN, C. The role of speech. *Elem. Engl.*, 29, 1952, 6-14.

This discussion of the objectives for study in speech improvement considers, in general, some of the techniques that might be used by the elementary teacher. The article includes a bibliography of 96 items. (*C.G.W.*)

News And Announcements

An outstanding event in field of audiology was the recent International Course in Audiology, meeting in Stockholm, Sweden. Approximately 110 otolaryngologists met, and nine audiologists from the U. S. A. participated. A full report of the meetings, including all papers presented, will appear in Vols. 40 and 41 of *Acta-Otolaryngologica.* Among the presentations were: Ira Hirsh, 'Audiology and the Basic Sciences'; Raymond Carhart, 'Basic Principles of Speech Audiometry'; John Bordley and William Hardy, 'The Etiology of Deafness in Young Children'; William Hardy, Miriam Pauls and John Bordley, 'Modern Concepts of Rehabilitation of Young Children With Severe Hearing Impairment.'

A clearinghouse service on competent, ethical technicians specializing in braces, limbs, obturators, or facial and body prostheses is being established by the Academy-International of Medicine, 214 W. Sixth St., Topeka, Kansas. Names and addresses of all qualified specialists should be sent to the Academy.

The Office of Education, Federal Security Agency, will make a study this year of the qualifications and preparation of those needed to teach the nation's nearly five million school-age exceptional children. The study has been made possible by a grant of $25,000 from the Association for the Aid of Crippled Children. Chief emphasis of the study will be upon qualifications of teachers of exceptional children and the curricula of colleges offering courses for such teachers. Romaine Mackey will direct the study.

Arnold Gesell's research work has now led to the formation of an independent institute with the name Gesell Institute of Child Development. Frances L. Ilg has been named Acting Director of the Institute. Dr. Gesell is Research Consultant.

A state professional organization, to be known as the Kansas Speech and Hearing Association, was proposed at a founders meeting at the Institute of Logopedics in February. A constitutional meeting is being planned for the fall. Dr. Martin Palmer is the temporary chairman and Dr. Geneva Herndon, Hayes State College, is the temporary secretary.

Paul H. Ptacek, of Minneapolis, has been awarded the first scholarship from the Speech Correction Fund for a year's research study in the field of speech handicaps in children. Two additional scholarships will be awarded in 1952, made possible by a grant from Kappa Delta Phi. The Speech Correction Fund was set up as a cooperative project of the National Society for Crippled Children and Adults and the American Speech and Hearing Association to award scholarships for research into the causes and treatment of speech handicaps.

The first large-scale demonstration of the benefits of integrating psychiatric treatment with already established rehabilitation techniques aimed at retraining the physically disabled will be made over a three-year period at the Institute of Physical Medicine and Rehabilitation, a unit of the New York University-Bellevue Medical Center. Establishment of the new demonstration program has been made possible by a grant of $73,500 to New York University College of Medicine from the Commonwealth Fund.

Three new speech therapy centers, in areas previously lacking such service, have been initiated at Woodsfield, Mt. Vernon and Miami County by the Ohio Society for Crippled Children.

George Pepperdine College in Los Angeles formally opened its new speech clinic in March. Dr. Glen G. Gooder has been named to direct the new clinic.

News And Announcements is edited by Charles R. Elliott, Northwestern University, assisted by the following committee: Jane Beasley, University of Alabama; George Gens, Newark (New Jersey) State Teacher's College; Elise Hahn, University of California at Los Angeles; Earl Schubert, State University of Iowa.

Speech Correction and Hearing is one of four areas included in the new Teacher-College-Board-approved graduate curriculum of the Department of Speech of Illinois State Normal University.

Syracuse University's Hearing and Speech Center has become affiliated with the Rochester School for the Deaf in a teacher training program.

The University of Pittsburgh is starting a program this summer for the training of teachers of the deaf. The program will lead to the Master of Education degree and will be supervised by Leo Doerfler.

The St. Barnabus Hospital (Newark, N. J.) has formed a center for cleft palate rehabilitation, under the direction of Dr. Lyndon Peer. The center serves the functions of diagnosis, therapy and research. Members of the team consist of specialists in the fields of dentistry, oral surgery, orthodontia, audiology, pediatrics, psychology, social service and speech pathology. George W. Gens has been appointed speech pathologist for the center.

The University of Akron (Ohio) has extended its community services to include a special speech clinic for children of school age, under the direction of Elizabeth Hittle.

Among new course offerings at Manchester (Indiana) College are Speech Pathology and Language and Thought (general semantics).

A conference on Speech Analysis will be held at Massachusetts Institute of Technology, June 16-17. Sponsored by the Acoustical Society of America, the Psycho-Acoustic Laboratory of Harvard University, together with the Acoustics Laboratory, the Research Laboratory of Electronics, and the Speech Analysis Project of the Carnegie Grant for Scientific Aids to Learning at M.I.T., the conference will consider speech from three principal points of view: perception, linguistics, and acoustics. Address inquiries to Professor William N. Locke, Head of the Department of Modern Languages, Room 14-SM48, M.I.T., Cambridge 39, Mass.

Carl K. Schmidt, Jr., former executive secretary and chief administrative officer of the Illinois Public Aid Commission, has been named assistant executive director of the National Society for Crippled Children and Adults.

Temple University held its Ninth Annual Reading Institute in Philadelphia, January 28-February 1, 1952. This year's conference was the first of a series of three annual institutes planned as a unit to deal with distinct problems without duplication. Coming conferences are: Curriculum Approach to Reading Instruction, February 2-6, 1953; Differentiated Guidance in Reading, February 1-5, 1954.

The Children's Hospital in Pittsburgh has recently organized a cerebral palsy diagnostic team consisting of specialists in the fields of pediatrics, physical medicine, neurology, audiology, psychology and speech pathology. Leo Doerfler and Jack Matthews are representing the areas of Audiology and Speech Pathology.

A film on speech education is now being produced by the University of Southern California Cinema Department, under the direction of Dr. Lester Beck, in collaboration with Orange County Schools. This sound and color film stresses the classroom approach and is designed to show a complete speech program, including the speech clinic, counseling and in-service training of teachers.

The Instrument Society of America is enlarging its scope of activities with the appointment of a number of new committees, notably those on medical and biological instrumentation. The Seventh Annual National Instrument Conference and Exhibit will include a few papers on these new topics. The meetings are scheduled for September 8-12 at Cleveland. The national office of the society is at 1319 Allegheny Ave., Pittsburgh 33, Pa.

Speech and hearing therapists of Pennsylvania recently organized as one division within the Pennsylvania Speech Association. Jack Matthews served as chairman of the group during its organizational year. Leo Doerfler was elected President for 1951-1952.

The Institute of Logopedics at Wichita, Kansas has changed the name of its publication from *Spastic Review* to *Cerebral Palsy Review* and expanded it considerably.

A new speech correction school has been developed in Lexington, Ky. by the Lexington Junior League, in conjunction with the University of Kentucky. The school presents a day program to help children between the ages 6-12 with their regular school subjects along with their speech needs. Each pupil must attend a minimum of four months. Dr. Charles F. Diehl is director of the school.

The University of Pittsburgh School of Nursing sponsored an Institute for School Nurses, February 7-9, 1952, on 'Hearing Problems of the School Child.' The institute registration was over-subscribed and the School plans to conduct such an institute annually hereafter. The institute staff was provided from the Audiology Clinic and medical staff of the Pittsburgh Eye and Ear Hospital. Betty Jane McWilliams and Gladys Fish were outside consultants for the institute.

A number of announcements have been received regarding summer programs and plans: Stanford University will add two new courses to the summer program, Stuttering: Modern Theories and Therapies, and Speech Correction for the Physically Handicapped, and will operate clinics for both courses, which are being taught by Dr. Mary Huber. The University of Buffalo is sponsoring an out-patient cleft palate clinic July 7-August 15, under the direction of Velma Hailman Carr. The third summer special training program for preschool deaf children and their parents will be sponsored again this year by the Pennsylvania Society for Crippled Children and Adults and the University of Pittsburgh. The program will be conducted at Camp Easter Seal, under the direction of Dr. Bruce Siegenthaler. Denver University will hold a workshop in speech reading and auditory training as part of its summer program. Marquette University in Milwaukee will offer its first summer workshop in speech correction for the classroom teacher during June 23-August 2. Syracuse University will again sponsor a summer residential school for speech and hearing handicapped children as part of its workshop program. The University of California at Los Angeles will sponsor a two-week workshop on Speech for the Classroom Teacher under the guidance of Dr. Donald Hargis, Dr. Elise Hahn, Dr. Waldo Phelps and Frances Hebb.

The State University of Iowa will sponsor a conference on stuttering, June 27-28. Dr. Lee Travis and Dr. Charles Van Riper, as guest speakers, will join Dr. Wendell Johnson on the program. Northwestern University will conduct a workshop on remedial work with out-patient children. A summer feature will be a symposium on 'The Language Needs and Language Behaviour of Children' with outstanding guest lecturers participating. Vanderbilt School of Medicine, George Peabody College and The Tennessee Hearing and Speech Foundation will offer a broad summer program June 16-August 23, 1952. Concentrated two-week seminars will be offered on the homebound child (June 23-July 5), the gifted child (July 7-19), and the speech and hearing handicapped child (July 21-August 2). Bachelor's and master's programs are available in speech correction, audiology and special education. The University of Pittsburgh will offer a course 'The Role of Communications in Human Relations,' which will consist, in part, of lectures by various specialists. Wendell Johnson will open the series. The Pennsylvania State College will continue its usual summer residential speech clinic as a workshop for its teacher training program. It will hold its fifth annual speech and hearing conference June 16-27. The program will be sponsored jointly with the Pennsylvania Society for Crippled Children and will deal with the areas of the cerebral palsied and the hearing handicapped child.

News from several meetings held this spring is of interest to speech and hearing workers: The Louisiana Speech and Hearing Association held its annual meeting on the campus of Southern Louisiana Institute at Lafayette with Rho chapter of Sigma Alpha Eta as host. The program centered around certification and the raising of standards within the state. Jeannette Laguaite was elected president and Betty Caraway was chosen secretary for the coming year. Lee Travis was the principal speaker at the Southern Speech Association Convention in April, at Jackson, Mississippi. He spoke on 'Psychological Problems in Speech Correction.' The twenty-first Rocky Mountain Speech Conference was held February 14-16 at the University of Denver. Speech correction and hearing problems were represented throughout the three days of meetings.

Eldon Jerome was chairman of a panel on 'What is the Job of a Speech Correc-

tionist in Various Setups?' at the Eastern States Speech Association Conference in April. Members of the panel were Jack Matthews, Jon Eisenson, Letitia Raubicheck, Robert West and Merle Ansberry. The Professional Conference of the Indiana Speech and Hearing Therapy Association, meeting at Bloomington, March 28, featured a workshop on stuttering by Wendell Johnson, and lectures by Eugene T. McDonald on cleft palate therapy and by Richard Silverman on pros and cons of the oral day school for the deaf. The California Speech Therapy Association, Central Section, met at Fresno State College in May. Dr. Mary Huber and John N. Wilde, M.D., spoke on cleft palate therapy. The Southern Section met May 10 in San Fernando. Dr. Dorothy Baruch was the featured speaker. The Central States Speech Association Conference was held at Tulsa, Oklahoma, April 17-19. A round table series was held on 'Unity and/or Diversification in the Development of our Regional and National Speech Groups.'

Careers in Service to the Handicapped, a 53-page booklet on the professions of physical therapy, occupational therapy, speech and hearing therapy and special education, has been distributed this spring to 20,000 high school vocational guidance specialists by the National Society for Crippled Children and Adults. The booklet has special sections on each of the four fields, prepared from materials supplied by professional organizations in these fields. Each section gives a background of the profession, lists qualifications, school and training requirements and gives salaries and working conditions. The purpose of the booklet is to give basic authoritative information on professions in rehabilitation.

Meetings Announced

American Speech and Hearing Association, November 20-22, Detroit, Michigan.

Speech Association of America, December 29-31, Netherland-Plaza Hotel, Cincinnati, Ohio.

American Psychological Association, September 1-6, Washington, D. C.

American Association for the Advancement of Science, December 26-31, St. Louis, Missouri.

National Society for Crippled Children and Adults, October 26-30, Fairmont Hotel, San Franciso, California.

Acoustical Society of America, November 13-15, San Diego, California.

American Physical Society, June 30-July 3, Denver, Colorado.

Regional Speech Association Meetings: Pennsylvania, September 26-27, Penn Alto Hotel, Altoona; New England, November 21-22, Boston; Western, Thanksgiving weekend, Denver.

The Pacific Division of the A.A.A.S., June 16-21, Corvallis, Oregon.

New Materials

Mohawk Business Machines Corporation, 47 West St., New York City, is marketing a midget-sized automatic tape recording and playback unit weighing six pounds, six inches square, for continuous play or intermittent repetition of messages.

Two filmstrips, produced by the Speech and Hearing Clinics and available at the University of Denver Press, cover the field of speech correction and audiology. *These Untrained Tongues*, by Dr. Ruth Clark and Miss Libby Radus, deals with speech disorders and their rehabilitation and *Out From Silence*, by Dr. R. E. Shutts and Mrs. Marion Downs, deals with the problem of hearing disorders and their rehabilitation.

Two new portable tape recorders have recently been announced. The Travis Tapak (Broadcast Engineer's Speciality Co., 101-38 121st St., Richmond Hill 19, New York City) 16 lbs., tape speed 7½, 600 ft. tape, alternate speed 3¾ available, continuous monitoring headset, rewinds at 44, battery powered with spring-wind tape drive mechanism. The Magnemite (Amplifier Corporation of America, 398 Broadway, New York 13) 9¾ lbs., tape speed 1⅞, battery powered, spring-drive tape transport mechanism.

A new self-timing leader tape of durable white plastic has been developed for use with magnetic tape rolls. It can be marked with pencil or ink and comes in 150-ft. rolls in self-dispensing container, 60c per roll (Audio Devices, 444 Madison Ave.,

New York 22). Audio Devices publishes a monthly house organ, *Audio Record*, which is filled with news on sound recording. It will be sent regularly to those requesting it.

A useful and extensive catalog of audio equipment may be had from Sun Radio and Electronics Co., Inc., 122-124 Duane St., New York 7. It contains simple and detailed discussions of the various components of an audio system, and the principles of choosing and linking components.

A 'Jolly Jim Talking Clown' has been received for use in speech correction with children. A plastic clown face is mounted on a tall flexible rubber base which permits attachment to any surface. The face swings freely and emits a cry with each swing (Jolly Blinker Co., Inc., 660 Cauldwell Ave., New York 55).

The American Standards Association has recently issued an *American Standard Acoustical Terminology*. It represents four years of work by a joint committee of the Acoustical Society of America and the Institute of Radio Engineers. Several new areas, among them ultrasonics, underwater sound, recording and reproducing, shock and vibration and acoustical units are covered in this latest edition.

The first annual report of the National Science Foundation contains several sections of general interest. A large part of the report concerns itself with the problem of federal support for basic research and the dangers of the critically short interval between discovery and application. Copies of the report are available from the Superintendent of Documents, Washington 25, D. C.

'The Ear and How It Works,' by Francis L. Lederer, M.D., has been reprinted from the booklet, *If You Have A Deaf Child* (published for the Illinois Annual School for Mothers of Deaf Children by the University of Illinois Press), and is being distributed gratis by Zenith Radio Corporation, Hearing Aid Division, 5801 Dickens Ave., Chicago 39.

Reprints of a four-page article, 'Junior Has a Hearing Loss,' from the December issue of *Hearing News* are available from the American Hearing Society, 817 14th St., N. W., Washington 5, D. C. The article discusses signs of hearing loss in children.

A booklet, *Speech Correction in the Chicago Public Schools*, has been made available by Dr. Margaret E. Hall, Director of the Division of Speech Correction for Chicago Public Schools. The booklet is reprinted from a larger book describing all of the special education services in Chicago Public Schools. Among the significant growth factors in the Chicago system has been the recent upgrading of professional background of the correctionists employed and the broadening of the source of personnel to include most of the major training centers.

A description of the program of the Children's Hearing and Aphasia Clinic of the School of Speech of Northwestern University is available by writing the Director, Dr. Helmer R. Myklebust.

A large descriptive booklet about *Shady Trails, The National Speech Improvement Camp*, has been issued by the Camp Director, Mr. John Clancy, 1007 E. Huron St., Ann Arbor, Michigan.

The Test Division of the Psychological Corporation (522 Fifth Ave., New York 36) has issued a new 62-page catalog giving a comprehensive listing of psychological tests.

Associated Films, Inc. have made available without charge, except transportation, a 20-minute 16mm sound film, *I See The Wind*. This is the story of a nursery school for blind children. The film may be requested from their offices at 35 W. 45th St., New York City; 79 E. Adams St., Chicago; 315 Turk St., San Francisco; 1915 Live Oak St., Dallas.

A *Directory of 2,002 16 mm Film Libraries* is available from the Superintendent of Documents, Washington 25, D. C. for 30 cents. This annotated directory of film libraries is arranged by states and will provide information concerning the resources and services offered. Order by catalog no. FS 5.3:951/11.

The twenty-seventh edition of the *Blue Book of 16 mm Films* ($1.50) has just been issued by *The Educational Screen*, official journal of the National Education Association's Department of Audio-Visual Instruction. More than 7,000 films are described and over 1,000 new titles have been added since the last edition.

A list of Veterans Administration films produced for the Department of Medicine and Surgery and available on a free loan basis has been issued by the Department of Medicine and Surgery, Veterans Administration, Washington 25, D. C. All requests for the loan of films should be addressed to Central Office Film Library, Court 5, South Building, U. S. Department of Agriculture, Washington 25, D. C.

The latest edition of the *Psychological Cinema Registrar Catalog* has been received. This is a comprehensive annotated listing of instructional and documentary films in the general areas of psychology and psychiatry. The catalog may be had by writing the Psychological Cinema Registrar, The Pennsylvania State College, State College, Penna.

Graduate Assistantships, Fellowships, and Scholarships

This section lists part-time graduate appointments, fellowships, and scholarships specifically designated for graduate work in speech and hearing. General university fellowships and scholarships, unspecified as to area of concentration, and full-time graduate positions will not be included.

Copy should be submitted to the News and Announcements Editor, and should include formal title of appointment, institution, and unit; dates, general duties, and remuneration; name and address of persons receiving applications. Deadline for receiving copy is two months prior to the publication date.

Clinical Assistantships. Purdue University. Speech and Hearing Clinic. Starting September or February. Half-time; 20 hours per week of clinical assistance. $1200 for regular school year; waiver of tuition fees. Student may enroll for 10 semester hours of graduate courses. Address M. D. Steer, Speech and Hearing Clinic, Purdue University, West Lafayette, Indiana.

Clinical Assistantships. University of Illinois. The Speech Clinic, Department of Speech. Starting September or February. Half-time; 20 hours per week of clinical assistance. $1290 for nine months; remission of tuition. Student expected to enroll for three-fourths of normal graduate course load. Address Karl R. Wallace, 138 Lincoln Hall, University of Illinois, Urbana, Illinois.

Clinical Assistantships. University of Southern California. Speech Department. Diagnosis and supervision of cases in the Speech and Hearing Clinic equivalent to 6 or 8 units of work per semester. $80.00 per semester unit of work; free tuition not included. Assistants normally carry 8 to 12 units of study per semester. Address Milton Dickens, Department of Speech, University of Southern California, Los Angeles 7, California.

Clinical Assistantships. The Pennsylvania State College. Speech and Hearing Clinic. Starting September or February. Half-time; 20 hours per week of clinical assistance. $1010 for academic year; exemption from incidental fee, general fixed fee, and out-of-state tuition. Student must carry 20 semester hours of credit during the academic year. Address Eugene T. McDonald, Speech and Hearing Clinic, The Pennsylvania State College, State College, Pennsylvania.

Clinical Assistantships. University of Denver. The Adult Speech and Hearing Clinic. For the year 1952-53, assistantships in hearing testing, aphasic therapy, and speech and hearing therapy. Address Elwood Murray, School of Speech, University of Denver, Denver, Colo.

Clinical Assistantships. University of Pittsburgh. Speech Clinic. Starting September. 18 hours per week of clinical assistance. $1000 for 9 months; $200 additional for summer session. Student may enroll for three-fourths of normal graduate course load. Address Jack Matthews, Speech Clinic, University of Pittsburgh, Pittsburgh, Penna.

Clinical and Research Assistantships. Ohio State University. Department of Speech. Starting September, January, March or June. 15 to 25 hours per week of clinical or research assistance. Two-thirds to three-fourths graduate load. Address W. Hayes Yeager, Chairman, Department of Speech, The Ohio State University, Columbus, Ohio.

Research, Clinical and Technical Assistantships. State University of Iowa. Speech Clinic and Experimental Phonetics Laboratory. Starting September 1. Half-time; 20 hours per week. $720 to $900 for nine months; remission of tuition. Assistants allowed to carry 12 semester hours of course work. Applications for the 1952-53 academic year received until July 1, 1952. Address

Wendell Johnson, Speech Clinic, State University of Iowa, Iowa City, Iowa.

Research Assistantships. Purdue University. The Voice Science Laboratory, Department of Speech. Starting September or February. Half-time; 20 hours per week of laboratory research assistance. $1200 for regular school year; waiver of tuition fees. Student may enroll for 10 semester hours of graduate courses. Address M. D. Steer, Voice Science Laboratory, Department of Speech, Purdue University, West Lafayette, Indiana.

Teaching Assistantship. Western Reserve University (Granted by the Cleveland Hearing and Speech Center). Winter and Spring Sessions; 9 hours of tuition exemption each session. $500 for five morning sessions weekly, teaching preschool deaf. Address Director of Admissions, Western Reserve University, 11124 Euclid Ave., Cleveland 6, Ohio.

Teaching Assistanships. Purdue University. Department of Speech. Starting September or February. Half-time; 8 hours per week of clinical work and 12 hours teaching duties in required beginning speech course. $1200 for regular school year; waiver of tuition fees. Student may enroll for 10 semester hours of graduate courses. Address A. H. Monroe, Department of Speech, Purdue University, West Lafayette, Indiana.

Graduate Assistantships. Northwestern University. Speech Clinic, School of Speech. Starting fall quarter. 12 hours per week of clinical assistance and research in stuttering. $1000 for 9 months. Address Charles R. Elliott, School of Speech, Evanston, Illinois.

Graduate Assistantships. Syracuse University. Hearing and Speech Center. Starting September. 20 hours per week. $1200 per year; no remission of fees. Student expected to enroll for 9 hours of course work each semester. Address Louis M. DiCarlo, Hearing and Speech Center, Syracuse, New York.

Graduate Scholarships. Central Institute for the Deaf. Tuition scholarships for teacher training course in education of the deaf and hard of hearing, and in speech correction. Address Registrar, Central Institute for the Deaf, 818 South Kingshighway, St. Louis 10, Missouri.

Graduate Scholarships. Western Reserve University (Training at the Cleveland Hearing and Speech Center). Remission of full tuition. Applications received immediately. Address Director of Admissions, Western Reserve University, 11124 Euclid Ave., Cleveland 6, Ohio.

Gradaute Scholarships. Awarded by the Speech Correction Fund for study at colleges or universities offering training beyond the Master's degree. $500 per year, beginning September or June; applicant must hold the Master's degree, or equivalent, in speech pathology or allied field. Address Mrs. Marceline Jaques, Scholarship Committee, Room 1020, 11 S. LaSalle St., Chicago 3, Ill.

Graduate Scholarships. Awarded for special study in cerebral palsy by Alpha Chi Omega and the National Society for Crippled Children and Adults. Grants vary between $100 and $750 for a minimum of three months at a recognized training center. Address National Personnel Registry and Employment Service, 11 S. LaSalle St., Chicago 3, Ill.

Graduate Scholarships. Kenfield Memorial Scholarship, awarded by the American Hearing Society to prospective teachers of lipreading to the hard of hearing. Available only to college graduates not already teachers of lipreading. Applications must be filed between March 1 and May 1. Address Miss Rose V. Feilbach, 1157 N. Columbus Street, Arlington, Va.

Graduate Scholarships. Grants-in-aid awarded by the Audiology Foundation. $500 per year, for students entering into or already engaged in any branch of audiology, including otology, audiometry, speech, acoustics, and the education of the deaf or hard of hearing. Address The Audiology Foundation, 1104 S. Wabash Ave., Chicago 5, Ill.

Working Scholarships. Western Reserve University (Employment at the Cleveland Hearing and Speech Center). Remuneration and working time arranged according to demands for clinical service and needs of student. Address Director of Admissions, Western Reserve University, 11124 Euclid Ave., Cleveland 6, Ohio.

Fellowships. Central Institute for the Deaf. Fellowships in education of the deaf and

hard of hearing, speech correction, audiology, acoustics, neuro-physiology, experimental otology. Stipends to be arranged according to background and needs of applicant. Address Registrar, Central Institute for the Deaf, 818 S. Kingshighway, St. Louis 10, Missouri.

Fellowships. The Johns Hopkins University. Hearing and Speech Center. Two special fellowships in audiology and speech awarded annually; may be continued at discretion. $3100; no duties beyond satisfactory pursuit of graduate requirements. Applications considered at any time; awards made in June. Address William G. Hardy, Hearing and Speech Center, The Johns Hopkins Hospital, Baltimore 5, Maryland.

Fellowships. University of Wichita (Employment in the Institute of Logopedics). Eight service fellowships; duties primarily clinical. $200 to $250 per month; student is expected to pursue course work toward the M.A. degree. Address Martin F. Palmer, Institute of Logopedics, 2400 Jardine Drive, Wichita 14, Kansas.

Fellowship. State University of Iowa. Fellowship in audiology. Starting September 1. Half-time; 20 hours per week. $1000 for nine months; remission of tuition. Fellows allowed to carry 12 semester hours of course work. Applications for the 1952-53 academic year received until July 1, 1952. Address Wendell Johnson, Speech Clinic, State University of Iowa, Iowa City, Iowa.

Fellowships and Assistantships. Stanford University. Duties may include teaching voice and diction, the language training program for foreign students, or clinical work in the Speech and Hearing Clinic. Remuneration varies with work done. Address Virgil A. Anderson, Speech and Hearing Clinic, Stanford University, California.

News about People

Evelyn Konigsberg has been appointed Assistant Director of the Department of Speech Improvement for the Board of Education of the City of New York.

Evelyn Corgan has joined the staff of the Department of Audiology of the Eye and Ear Hospital of Pittsburgh as a clinical audiologist and supervisor of speech.

William Perkins will join the staff of the Department of Speech and the Speech and Hearing clinic of the University of Southern California in September.

Margaret E. Hall has announced the following as new staff members of the Division of Speech Correction of the Chicago Public Schools: Virginia Elder, Marilyn Kipnis Hersh, Gwendolyn Baylor Matterre, William Vickers, and Harry Kone.

Spencer Brown and Eugene T. McDonald have been awarded scholarships by the National Society for Crippled Children and Adults for the study of cerebral palsy.

Ruth Clark has returned from teaching at the University of the Witwatersrand in Johannesburg, South Africa to her position as Director of the Children's Speech Clinic at the University of Denver.

Richard A. Winchester has been appointed Acting Director of the Adult Speech and Hearing Clinics at the University of Denver during the current year.

Lucie Lawson has been appointed Director of the newly formed Speech Clinic in Franklyn Hospital, San Francisco.

Jack M. Ross has accepted a position as speech correctionist for Fayette County, Iowa.

Barbara J. Stansell has been appointed as a speech correctionist to the staff of the Veterans Hospital, Minneapolis, Minnesota.

Dorathy Ecklemann has returned to her position as Assistant Director of the Speech Re-Education Clinic, Illinois State Normal University, Normal, Illinois, having completed a doctoral program at the State University of Iowa.

CLINICAL CERTIFICATION REQUIREMENTS *of the* AMERICAN SPEECH AND HEARING ASSOCIATION

TO HELP the speech and hearing handicapped obtain high quality rehabilitation programs and to maintain standards throughout the profession, the American Speech Correction Association in 1942 adopted a program for certifying speech correctionists (*3*). When the Association was broadened to include persons interested in hearing, standards for certification in this area were developed. In 1950 the Association voted to reorganize its membership framework and in this reorganization, clinical certification was removed as a membership requirement. There are now two classes of membership, Member and Associate. To become a Member an applicant is only required to hold the Bachelor's degree or higher in the general area of the Association's interests; Associates have no academic requirements (*1*, *2*). There are four certificates of clinical competence, the Basic and the Advanced in Speech and the Basic and the Advanced in Hearing.

At the 1950 Annual Convention a Committee on Clinical Standards in Speech and a Committee on Clinical Standards in Hearing were established to study and define the requirements for certification of clinical competency in their respective areas (*4*). After a detailed analysis of certification problems these Committees developed tentative minimum standards for the basic and advanced certificates in the two fields and submitted their proposals to persons who had previously been certified for their evaluation. These standards were carefully considered by the Executive Council and at the 1951 Annual Convention the Association approved a set of minimum standards for certification which reflected the thinking of the Standards Committees, persons in the field who had been previously certified, the Executive Council, and the Association Membership. These standards are outlined in Table 1.

Also at the 1950 Annual Convention a Committee on Clinical Certification was established to process applications for clinical certification employing the qualification standards recommended by the Clinical Standards Committees (*3*). The By-Laws of the Association specify that this Committee shall consist of an elective chairman, and at least eight other appointive members, four in speech and four in hearing, all of whom hold the Advanced Clinical Certificate, and that each application shall be acted upon by at least four members holding Advanced Certification in the

These requirements were recommended by the Committee on Clinical Standards in Speech (Margaret E. Hall, Jack Matthews, D. C. Spriestersbach, Kenneth Scott Wood, Eugene T. McDonald, Chairman) and the Committee on Clinical Standards in Hearing (Merle Ansberry, Hallowell Davis, LeRoy D. Hedgecock, Hayes A. Newby, Leo G. Doerfler, Chairman), and approved by the Executive Council and by the Membership at the 1951 Annual Convention. The published statement was prepared by the Chairmen of the two Committees.

TABLE 1. Minimum requirements for clinical certification by the American Speech and Hearing Association.

General Requirements

1. A bachelor's degree or higher as certified by transcripts from the awarding institution.
2. Membership in the American Speech and Hearing Association as certified by the Chairman of the Committee on Membership.
3. Subscription to the Code of Ethics of the Association as indicated by the applicant's signature on the application blank.

Requirements for Basic and Advanced Certificates in Speech
(*Content of these items is required)

	Semester Hours	
	Basic	*Advanced*
1. Basic areas: Anatomy and physiology of the ear and vocal mechanism, phonetics, semantics, speech and voice science, psychology of speech, experimental phonetics, and similar areas.	6	9-12
2. Specialized, professional course content in speech correction and speech pathology:	12	21-24
Course content:		
*At least two courses in speech correction and/or speech pathology.		
Elective:		
Stuttering, voice disorders, articulation disorders, cleft palate, aphasia, cerebral palsy and similar areas.		
Clinical practicum:		
*Basic: at least 200 clock hours; Advanced: additional equivalent of 3 semester hours in advanced practicum. (up to 20 hours of audiology practicum may be applied)		
3. Specialized, professional course content in audiology:	3	6-9
*Hearing problems and the testing of hearing.		
Elective:		
Introduction to audiology, auditory training, speech reading, speech for the acoustically handicapped, problems of the child with a hearing loss and similar areas.		
4. Other areas:	9	15-18
*Child psychology (or child development)		
*Mental hygiene (or psychology of adjustment)		
*Candidates for the Advanced Certificate must present a total of 12 semester hours in psychology beyond the elementary courses		
Electives in appropriate areas		
5. Professional experience:		
*Basic certificate: one year of preregistered experience following the completion of the above listed academic requirements.		
*Advanced certificate: four years of preregistered experience following the completion of the above listed academic requirements for the basic certificate.		

Requirements for Basic and Advanced Certificates in Hearing
(*Content of these items is required)

1. Basic areas: Phonetics, anatomy and physiology of the vocal mechanism, anatomy and physiology of the ear, speech and voice science, experimental phonetics, psychology of speech, acoustics, physics of sound, etc.	6	9-12

2. Specialized, professional course content in audiology:	12	21-24
Course content:		
*Hearing problems and hearing testing		
*Speech reading		
*Auditory training		
Elective:		
Hearing aids, hearing clinic management, aural rehabilitation, audiologic instrumentation, speech for the aurally handicapped, field work in audiology, seminar in audiology, preschool deaf child, education of the deaf, etc.		
Clinical practicum:		
*Basic: at least 200 clock hours; Advanced: additional equivalent of 3 semester hours in advanced practicum. (up to 20 hours of speech practicum may be applied)		
3. Specialized, professional course content in speech correction:	3	6-9
*Speech pathology		
Elective:		
Stuttering, voice disorders, articulation disorders, cleft palate, cerebral palsy, aphasia, etc.		
4. Other areas:	9	15-18
*Child psychology (or child development)		
*Psychology of adjustment (or mental hygiene)		
*Candidates for the Advanced Certificate must present a total of 12 semester hours in psychology beyond the elementary courses		
Electives in appropriate areas		
5. Professional experience:		
*Basic certificate: one year of preregistered experience following the completion of the above listed academic requirements.		
*Advanced certificate: four years of preregistered experience following the completion of the above listed academic requirements for the basic certificate.		
6. Recommendation:		
For Advanced Certification the applicant shall present a favorable recommendation from the director of the speech and hearing program in a department or institution offering advanced degrees in the field of hearing and speech.		
7. Examination:		
For Advanced Certification the applicant shall pass both sections of a written and oral examination. Other suitable evidence, as determined by the Committee on Clinical Standards in Hearing, may be accepted in lieu of the examination upon Council approval.		

Notes concerning certification requirements:

1. These listings are not necessarily course titles but rather suggestions of course content.
2. Any excess in groups 1 and 2 may be counted as electives in group 4.
3. See the definitions of 'clinical practicum' and 'professional experience' in the text.
4. Requirements for the Advanced Certificate include those for the Basic Certificate. Candidates for the Advanced Certificate have some options in distributing their training among the content areas; however, in each group the indicated minimum requirements must be met. No more than the indicated number of credits in each group will be counted toward the required total of 60 credits.
5. In evaluating credits, one quarter hour will be considered the equivalent of two-thirds of a semester hour.

area (speech or hearing) in which the applicant is seeking certification plus one other Committee member (*1*).

Definitions

Supervised clinical practice in speech and hearing. This training should be received as part of the applicant's formal academic preparation for the profession of speech and hearing therapist. Such practice training or practicum course is usually taken for college credit and is distinguished from the 'professional experience' also required for the basic and advanced certificates.

Practice training must be received in a situation where conferences can be held with a clinician holding the Advanced Certificate in the appropriate area of speech or hearing. Supervision must involve personal observation and checking of the applicant's diagnostic and therapeutic procedures, frequent checking on his cases and checking of his case records and reports. The training should provide experience with a variety of case types and ages.

Minimum standards for clinical practice:

1. Two hundred clock hours in such activities as employing diagnostic procedures, carrying out therapy, conferences with his supervisor and preparing records will be required. When practicum is offered as a specific course the student should spend 45 clock hours in the above listed activities for each semester hour of credit.

2. Observation time and time spent in preparation for therapy sessions may not be counted toward the 200 clock hours of supervised practicum.

3. The supervisor should observe the student clinician frequently enough to evaluate his skill in employing diagnostic techniques. He should be familiar with the problems presented by the patient in order to evaluate the effectiveness of the therapy employed by the student clinician to meet these problems. While the method of observation will vary, it is suggested that the supervisor should, in some way, observe the student clinician work with each of his patients approximately one out of every four treatment sessions. Diagnostic sessions should be observed more frequently.

4. While experience with a variety of cases is recommended, the beginning student clinician in speech should have an opportunity to work with at least three cases on an intensive basis and over a long enough period of time that positive results may be observed. Additional experience with other cases should be provided. Practice teaching must include some work with functional articulation cases.

The student hearing therapist should have experience with a variety of cases. Some experience should be gained in speech reading, auditory training and speech improvement. Experience with a variety of diagnostic procedures in addition to pure tone testing is recommended.

5. The 200 clock hours should include experience with cases ranging in age from preschool through adolescence stressing particularly the elementary school level. In addition to work with these age groups the student hearing therapist should have some experience with adults, especially those presenting hearing problems common to old age.

6. The supervisor should arrange for each of his student clinicians to observe patients assigned to other student clinicians and then schedule staff meetings or conferences in which clinicians can discuss each other's patients. In this manner the clinical experiences of students may be widened.

7. Each student clinician should keep a log of his supervised practice. This log should contain a brief description of each case examined and treated by the clinician, a record of the amount of therapy provided and the name of the immediate supervising clinician. Special attention should be given in these logs to the interpretation of the results of diagnostic techniques employed and to the objective evaluation of the effectiveness of the therapeutic procedures employed. Such logs will later serve as the basis for preparing the report of supervised clinical practice required for ASHA certification.

Professional experience in speech and hearing. One year is required for the Basic Certificate and four years are required for the Advanced Certificate. This experience is defined as post-academic (i.e., beyond the academic requirements for the basic certificate), preregistered, paid employment. The candidate must obtain as a sponsor or preceptor a person holding the Advanced Certificate in speech who will certify that the experience has been completed as preregistered.

The applicant's sponsor may be the professor who directed his clinical practice in college, if available, the supervisor of his preregistered position, or any person who

holds the Advanced Certificate with whom he can confer about his program.

Minimum standards for professional experience:

1. No credit will be given for any experience prior to the completion of the minimum academic requirements for the Basic Certificate. This means that all persons desiring certification should submit their academic credentials to the Committee on Clinical Certification as soon as they have completed the academic training required for the Basic Certificate. This must, of course, precede the preregistration of professional experience. If there are any deficiencies they will be notified at once so they can take steps to remove them before they begin their professional experience program.

2. Each candidate for Basic and Advanced certification must, using a special form, register his professional experience program with the Chairman of the Committee on Clinical Certification. This registration must be effected a year prior to the date when the candidate expects to receive credit for a year of professional experience. In registering the candidate must identify his sponsor. The Clinical Certification Committee will write to the sponsor confirming this relationship and informing the sponsor of his responsibilities. It will be the responsibility of the candidate to obtain forms from the committee and have his sponsor submit a report at the end of *each* year of experience.

3. It is recommended that there should be at least one conference between a candidate and his sponsor each year. When a personal conference is not feasible, the sponsor should correspond with the candidate about his program. The sponsor should determine if the candidate has discharged his clinical responsibilities to his employer's satisfaction during the year.

4. It is the spirit of this requirement that individuals shall have genuine, serious, responsible, professional experience. Widely scattered and slowly accumulated experience will not meet this requirement. One year of professional experience is defined as at least nine months of full time clinical work (minimum of 30 hours per week). No credit will be given for experience amounting to less than 15 hours per week. Persons devoting less than 30 hours per week to clinical activities may have to spend additional time to complete their professional experience requirement.

5. Professional experience is construed to mean direct clinical work with patients, consultations with parents, teachers, etc., examinations of patients, record keeping or any other duties relevant to a bona fide program of clinical work. If the applicant has teaching duties, as in most college and university situations, such teaching should not constitute more than one-third of his load if in speech correction courses nor more than one-fifth if in other areas. If the teaching load is heavier than indicated above, an additional amount of experience may be required.

Provisional Basic Certificate. The Committee on Clinical Certification will send each person who satisfactorily completes the minimum academic requirements for the Basic Certificate a letter indicating that these requirements have been met and that upon the satisfactory completion of a year of professional experience the applicant may be granted the Basic Certificate. This letter may be shown to prospective employers as evidence of certification status.

Procedures to be Followed in Applying for Clinical Certification

Provisional Basic Certificate. 1. Apply to the Secretary-Treasurer who is the ex-officio Chairman of the Committee on Membership for Membership in the American Speech and Hearing Association.

2. Upon receipt of notification of election to Membership obtain from the Chairman of the Committee on Clinical Certification the necessary application forms.

3. Complete these forms according to their accompanying instructions and mail them directly to the Chairman of the Committee on Clinical Certification.

4. Have an official transcript which covers all the academic work which is listed in the application sent to the Chairman of the Committee on Clinical Certification.

5. If the applicant meets the minimum academic requirements for the Basic Certificate he will receive a Provisional Basic Certificate. At the same time he will be sent a form for preregistering his experience.

Basic Certificate. 1. At the time the applicant enters the employment in which he plans to earn the required professional experience he should:

a. Obtain as sponsor or preceptor a person holding the advanced certificate.

b. Complete the preregistered professional experience form and return it to the

Chairman of the Committee on Clinical Certification.

2. After a year of professional experience has been completed obtain from the Chairman of the Committee on Clinical Certification a form for summarizing professional experience. When this has been signed by the applicant and his sponsor it should be returned to the Chairman of the Committee on Clinical Certification.

Advanced Certificate. 1. Applicants for the Advanced Certificate should preregister *each* year of professional experience following the procedures outlined in 1 and 2 under 'Basic Certificate.'

2. After the applicant has accumulated four years of successful professional experience and has completed the academic requirements for the Advanced Certificate he should obtain the necessary application forms from the Chairman of the Committee on Clinical Certification.

3. Complete these forms according to the accompanying instructions and mail them directly to the Chairman of the Committee on Clinical Certification.

4. Have an official transcript which covers all the academic work which is listed in the application sent to the Chairman of the Committee on Clinical Certification.

5. Candidates for Advanced Certification in hearing must, in addition to the above:

a. Present to the Committee on Clinical Certification a favorable recommendation as described in item 6 of the requirements.

b. Arrange with the Committee on Clinical Certification to take the examination as described in item 7 of the requirements.

References

1. By-Laws of the American Speech and Hearing Association. *JSHD*, 17, 1952, 108-112.
2. Editorial: The modern meaning of the American Speech and Hearing Association. *JSHD*, 16, 1951, 100-102.
3. Palmer, M. American Speech Correction Association membership regulations. *JSD*, 8, 1943, 41-51.
4. Report of the 1950 convention. *JSHD*, 16, 1951, 83-96.

Notice to Applicants for Certification

All persons who have completed the academic requirements for the now obsolete Clinical Membership by June 15, 1952, and who have one year of experience may be awarded the Basic Certificate.

All persons who have completed the academic requirements for the now obsolete Professional Membership by June 15, 1952 and who have four years of experience may be awarded the Advanced Certificate. Persons with experience in progress will receive credit for the amount completed by June 15, 1952. To receive credit for experience completed after that date it should be preregistered.

The deadline for applying for certification under this provision is September 1, 1952.

Notice to Applicants for the Advanced Certificate in Hearing

The examination required for the Advanced Certificate in Hearing is currently under construction by the Committee on Clinical Standards in Hearing. This examination will consist of two sections, written and oral. Both sections must be passed for successful completion of this requirement.

The Committee is making every effort to insure that the written examination may be taken by appropriately qualified applicants early in the fall. Requirements preliminary to the written examination are described above under Clinical Certification Requirements. The written examination will be given at the location of the applicant, under the supervision of an appropriate official of the local university. Where this is not possible other arrangements may be made.

Applicants shall communicate with the Chairman of the Committee on Clinical Certification, Eugene T. McDonald, Speech and Hearing Clinic, Pennsylvania State College, State College, Penna., indicating that they will have completed all other requirements by the end of the summer of 1952 and including the name, title and address of the official of the local university who shall have agreed to administer the examination.

Results of the examination in terms of passing or failure will be communicated to each applicant as soon as possible. Those persons passing the written examination shall be eligible to take the oral examination, which will be given on the day or days preceding the Annual Convention in Detroit on November 20-22.

CODE OF ETHICS
of the
AMERICAN SPEECH AND HEARING ASSOCIATION

Section 1. Ethical Responsibilities of Members and Associates

The American Speech and Hearing Association is composed of persons having varying interests and professional duties, but certain broad ethical principles apply to the entire membership. The application of these principles to individual cases will depend on the particular circumstances of the professional duties and status of the persons involved.

It is convenient to divide the ethical responsibilities of persons in clinical professions into (1) those duties arising out of the relation between the professional worker and the person who seeks his assistance; (2) duties owed to other professional workers; and (3) obligations to society. These classifications are arbitrary, for actually the duties and responsibilities of the professional worker are indivisible. Any one of these ethical duties clearly implies the other two.

A. The most frequent professional relationship involving Members of ASHA is that of therapist to patient. The ethical responsibilities of this relationship demand that the welfare of the patient be considered paramount. Accordingly, the therapist must possess suitable qualifications for engaging in clinical work. Measures of such qualifications are provided by the Association's program for certification of the clinical competence of Members. The therapist must use every resource available, including referral to other specialists as needed, to effect as great improvement as possible in the shortest time consistent with good professional practice. Every precaution must be taken against causing any sort of injury to the patient. These general principles are understood and accepted by the profession and the public alike. Their application is the daily task of every professional clinical worker.

Another frequent professional relationship of ASHA Members and Associates is that of teacher to student. The broad ethical responsibilities of the teacher who is a Member or Associate of ASHA are in no way different from those of any other teacher, and no special statement of ethical requirements is in order.

B. The duties owed by Members and Associates to other professional workers are many. They should disseminate results of research and developments in speech and hearing therapy. They should avoid personal controversy, but should seek the freest professional discussion of all theoretical and practical issues. They should establish harmonious relationships with members of other professions, and should especially endeavor to inform them concerning the services that can be rendered by speech and hearing therapists. They should strive to promote the status of ASHA, of the professions of speech and hearing therapy, and of all therapy for and research concerning handicapping conditions.

C. The duties owed to society include first all the obligations of good citizenship which devolve upon members of human society. As persons with special training, ASHA Members and Associates have additional special responsibilities. They should help in the education of the public regarding speech and hearing problems and other matters lying within their professional competence. They should seek to provide and expand services to persons with speech and hearing handicaps, and assist in establishing high professional standards for such programs.

Prepared by the Committee on Ethical Practice for 1951 (James F. Curtis, Darrel J. Mase, S. Richard Silverman, Kenneth Scott Wood, Spencer F. Brown, Chairman), this revised statement of the Code of Ethics was approved by the Executive Council and by the Membership at the 1951 Annual Convention.

Section 2. Unethical practices.

A. It shall be considered unethical:

1. To guarantee the results of any speech or hearing consultative or therapeutic procedure. Any guarantee of any sort, express or implied, oral or written, is contrary to professional ethics. A therapist may always make a reasonable statement of prognosis, but a 'cure' or other specific favorable outcome is dependent upon many factors outside the therapist's control. Hence any warranty is deceptive and unethical.

2. To employ blatant or sensational advertising. The only form of advertising permissible is the so-called 'business card,' consisting of the name of the person or institution, the type of therapy offered, office hours, address, and telephone number. The words 'type of therapy' refer to such phrases as 'Speech Therapy,' 'Speech and Hearing Therapy,' 'Disorders of Speech,' and similar phrases. Members not holding clinical certification are expressly forbidden to use the name of the Association in advertising or any other professional promotion.

3. To diagnose or treat speech or hearing defects by correspondence. This does not preclude correspondence follow-up of patients previously seen personally.

4. To violate the patient's confidence by revealing any information obtained from or about him without his express permission. Case records must not be used in teaching in such a way as to permit identification of their subjects.

5. To write or say anything which may discredit professional colleagues or members of allied professions other than that based on adequate and objective evaluation of their work.

6. To exploit patients (a) by accepting for treatment patients whose defects cannot reasonably be expected to improve under therapy offered; (b) by continuing therapy unnecessarily; (c) by charging exorbitant fees.

7. To deal with speech patients requiring medical treatment without the advice of a physician.

8. For any student in training, whether on the undergraduate or the graduate level, to treat speech or hearing patients except as this treatment is given under competent supervision and as part of the training program. It will not, however, be considered unethical for a graduate student who holds a Basic Certificate to engage in part-time speech or hearing therapy which is not part of the training program, provided that explicit approval of the director of such training program is secured in advance. A person holding a full-time clinical position and taking part-time graduate work is not, for the purpose of this Section, regarded as a student in training.

9. For any unqualified Member or Associate to treat speech or hearing patients, except under the supervision of one who is properly qualified.

10. To accept compensation from a dealer in prosthetic or other devices for recommending any particular device.

B. In addition to those which have been listed, other practices or actions might have an undesirable effect upon the patient, on relations with other professional personnel, or upon society, and would thus be unethical. It shall be the duty of the Committee on Ethical Practice to decide, in the light of all information it can collect, whether any specific act is in violation of the spirit of these Principles of Ethics.